The Psychology of Communication

W. Lambert Gardiner

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ACKNOWLEDGMENTS

This book evolved out of a course I have been teaching in the Department of Communication Studies at Concordia University in Montreal. During those 20-odd years, my students have provided feedback with quizzical expressions, subtle yawns, and clarifying questions - clarifying that is for the professor as well as for the student. Such “co-authorship” is rarely acknowledged - perhaps we should raise a monument to the Unknown Student.

One student must be singled out. Maya Pinkas created the images on the front cover. Those portraits, created out of a collage of images from her life and my life, beautifully celebrate the miracle that, despite our dramatically different life experiences, we can still communicate.

Some of my “teachers” also helped. The late great Dr. Ray Charron introduced me to evolutionary psychology. I greatly miss our breakfast meetings, but we are still communicating. Dr. Michael Hollinshead introduced me to the Santiago School of Cognition.

One of my teachers, Trisha Santa, is 40 years younger than me. She is thus much more at home than I on the other side of the “digital divide”, with video- and computer-based media, and kindly helps ME feel more at home there. She is my illustrator, copy editor, website manager (she keeps my virtual self alive at www.siliclone.com), computer guru, and good friend.

CHAPTER 1 PROLOGUE

1.1 PSYCHOLOGY IS DIFFICULT

1.2 COMMUNICATION IS IMPORTANT

1.3 PSYCOMM IS UBIQUITOUS

1.4 THE “APPROACH” APPROACH

Jack
knows he does not know
and sees that Jill
does not know she knows,
by telling Jack
what Jack knows that he does not know
Jill helps Jack to help Jill
to know she knows
what she does not know she knows

R. D. Laing
Knots, Page 62

1.1 PSYCHOLOGY IS DIFFICULT

A science is the study of a system. A system is a set of elements interrelated so that any change in one element leads to predictable changes in the other elements. If there is no system, then there is no prediction; if there is no prediction, then there is no science. A science is, therefore, I repeat, the study of a system. Physics is the study of the atom, astronomy is the study of the universe, psychology is the study of the person.

Since the person is the system which studies all the other systems, psychology is the central science.[1] Psychologists pay a price for this central role. The fact that the subject and the object are the same in our discipline (that is, one person is studying another person) leads to much conceptual confusion. Indeed, some philosophers of science have argued that our story will always be a to-be-continued story because it is no more possible for a system to fully understand itself than for a system to fully eat itself.

Further confusion arises when the process being studied is the same as the process by which it is studied (that is, one person is communicating about another person communicating). The issue is even further muddled by the fact that each person can study him/herself (that is, I can not only communicate about you communicating but I can communicate about me communicating). This can lead to an infinite regress, as I communicate about myself communicating about communicating about communicating, and so on, or it can lead to an eternal shuttle, as I communicate about you communicating about me communicating about you communicating, and so on. This results in the eternal shuttles and infinite regresses portrayed in Figure 1-1 and illustrated by the epigram at the beginning of this chapter.

Communicating is something which we all do naturally day by day. In this book, we will be communicating about communicating. There is a danger that we will be confused by this meta-communication. Like the legendary centipede which began to think about how it walked, we could find ourselves tripping over our own feet. However, it is more

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[1] Every professor will, of course, tell you that their discipline is central. Whenever you hear this, you should activate your bullshit-detectors or bummer meters or whatever they are currently called. In this case, however, it is true. The other professors are wrong!

likely that it will raise our consciousness of our consciousness, and improve our communication.

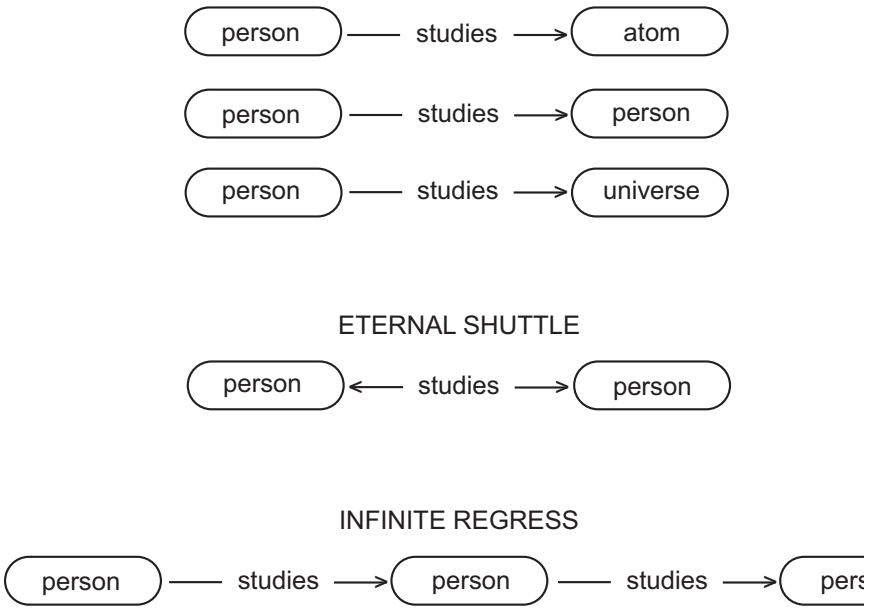

FIGURE 1-1
ETERNAL SHUTTLE AND INFINITE REGRESS

A second difficulty is that the system studied by psychologists is the most complex of all systems. The human brain which is central control for the nervous system, which is, in turn, central control for the person, contains more than 10 billion cells. These cells (variously described as the great raveled knot, the cerebral jungle, a can of spaghetti, or a bowl of porridge) may be combined in an uncountable number of ways. Such a system is much more complex than the atom, which has challenged our greatest minds for centuries and still retains much of its mystery. This is not rocket science. Rocket science is easy. It merely requires that we understand the simple mechanism we have built ourselves, Psychology requires us to understand the complex organisms created by nature.

A third difficulty is that there are certain ethical limitations to the ways in which our system can be studied. Physicists smash atoms and no one complains. Psychologists can not smash people without a roar of anguish from them and a roar of protest from others. Physicists may remove

an element from their system to observe the effect and thus determine its function. Psychologists may not remove an element from their system (e.g. cut off another person's cerebellum) to observe the effect and thus determine its function. Of course, such restrictions on the extent to which a person can tamper with another are commendable and essential. I am not advocating that they be removed (indeed, they should be even more rigorous) but merely pointing to yet one more difficulty confronting the scientist foolhardy enough to choose the person as the system to study.

Lauren Slater describes the great psychological experiments of the 20th century [SLATER]. One of those experiments demonstrated that we would administer severe electric shocks to another person if told to do so by an authority figure. Another demonstrated that we would become brutal if assigned the role of a guard in a simulated prison. Ethical constraints ensure that such experiments could not be conducted in the 21st century. They would have to be replaced by experiments in which subjects filled out questionnaires about how they would behave in those circumstance. Thus, we march into the future bewildered by the fact that “nice” people commit atrocities. Perhaps such constraints have less to do with our ethical concerns about the mistreatment of subjects and more to do with our prejudices about our selves.

This brings us to a fourth difficulty - prejudice. The study of the person by the person is often opposed by the person. Many people who accept the application of scientific thinking to the world around them refuse to accept the application of scientific thinking to themselves.

Perhaps this attitude is a residue of the same violent reaction to the theories of Copernicus, Darwin, and Freud, which offended - or seemed to offend - the dignity of the person. Copernicus plucked us from the centre of the universe, where the geocentric theory placed us, and put us on a broken-off fragment of one of a myriad of stars. Darwin plucked us from an exclusive niche in this little world, where the theory of special creation placed us, and put us where we belong with the other animals. Freud dealt our dignity a further blow by arguing that we are not even rational animals but are driven by instinctive forces of which we are not even aware. The reaction has become progressively less vicious. Things are getting better all the time. The contemporaries of Copernicus tried to burn his body; those of Darwin burned his books; those of Freud simply burned. There is still a whiff of burning in the air.

My personal prejudice is that it is not at all offensive to the dignity of the person to be studied. The beauty of the rainbow is not marred by

passing it through the spectroscope. Indeed, it is yet more awesome when understood. It is refreshing that we have finally summoned up enough courage to look ourselves straight in the eye and accept as much truth as we can manage about ourselves rather than continuing to believe what we want to believe. I agree with Hans Selye, the brilliant medical researcher at the University of Montreal, that "*the ugliest truth is more beautiful than the loveliest pretense* ".

Whether we should or should not study ourselves is, however, a purely academic question. We have been turning the searchlight of science on ourselves for some time in the past, we are doing it now at present, and we will continue to do so in the future. Our curiosity will not be curbed by force or by fiat. I can only report to you what we are doing and leave to you the question of whether we should or should not be doing it. An informed public is the best insurance that the study of people by people will benefit people.

1.2 COMMUNICATION IS IMPORTANT

Communication is an aspect of all systems. It is the “glue” which holds the elements together to form a system. My own Department of Communication Studies could perhaps be better named Department of Media Studies. It focuses on communication among people using media, leaving communication among the elements in an atom and among the planets in the solar system to their respective disciplines. The discipline I am carving out here and in two previous books - *A History of Media* [GARDINER 2002] and *Media: Past, Present, and Future* [GARDINER 2006] - is closer to Media Studies. However, unlike the various departments of Communication Studies, which do not have courses in interpersonal communication, it embraces memory and speech as a first generation of media. My argument is that the various media form a system only when considered as extensions of the nervous system. In this book, Communication Studies refers to the traditional concept of the discipline and Media Studies to this extended (and admittedly eccentric) concept.

I conducted an experiment on myself by recording the time I spent communicating. In Figure 1-2, which summarizes the first 26

weeks of my experiment, you can see that I typically spend over 70 hours a week - that is, over 10 hours a day - communicating. (The atypical times were that big dip in the middle, which corresponded to a trip to Europe. Mundane maintenance matters take more time when you are away from home - you have to find places to eat and to sleep. You can figure out the reason for the other dip during the first week of the new year for yourself).

You may argue that my life is not typical, since as a professor I am in the communication business. However, communicating has been a large part of most jobs and, as we move from an industrial society based on energy, into a post-industrial society based on information, the number of jobs and the proportion of each job based on communication is increasing.

The second most striking finding of my experiment was that I was never tempted to record for any half-hour period (my unit of analysis) that I was thinking. This was embarrassing at first, since, as a scholar, I should be spending a lot of time thinking. However, I gradually began to realize that I was thinking all the time, but there was always some type of communication involved. Since so much of my time was spent communicating, then I should devote much time to acquiring communication skills.

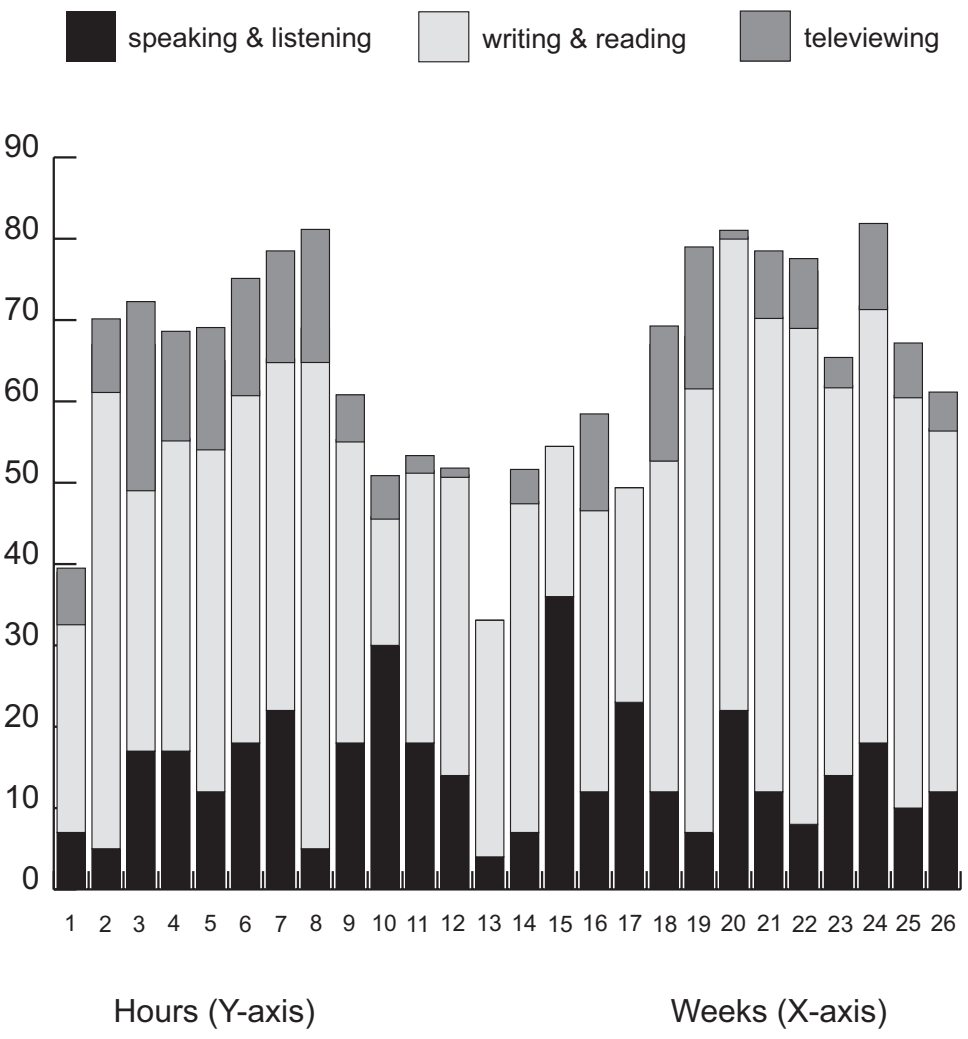

FIGURE 1-2 TIME SPENT COMMUNICATING

1.3 PSYCOMM IS UBIQUITOUS

Although its importance can not be denied, the Psychology of Communication (may I suggest Psycomm - in contrast to Masscomm - as a handy abbreviation?) is a difficult topic to get a handle on. Whereas most other disciplines can point to a system on which they focus,

communication studies can point only to an aspect of all systems. It is the "glue" which holds ALL systems together. The ubiquitous is paradoxically elusive. The fish will be last to discover water.

The Psychology of --- helps narrow the topic down somewhat. Psycomm obviously focuses down on the individual level of analysis in contrast to Mass Communication (Masscomm) which considers the institutional level of analysis. It is important that the usual sociological level of analysis (Masscomm) is supplemented by the psychological level of analysis (Psycomm). However, Psychology itself is a broad topic. The Psychology of Communication would thus seem to pile vagueness on vagueness. Everything seems to involve Psycomm.[2] In talking about everything, one runs the risk of saying nothing. Since the topic of this book - psycomm - is such a vast domain, there is a danger that we may focus on everything and therefore focus on nothing.

As one simple illustration of its ubiquity, I culled fifteen articles from *The Globe and Mail* and the *Montreal Gazette* during one week between two classes and demonstrated how they could all be considered as within the domain of Psycomm (see Figure 1-3).

1.4 THE "APPROACH" APPROACH

This book is designed to set up some centripetal forces to counter the centrifugal tendencies to fly off in all directions. Each chapter takes a different logical approach to the psychology of communication (see Figure 1-4). Each approach will cast some light on the topic from its peculiar perspective. The successive overlays on the various approaches will, it is hoped, present an illuminating picture of the topic. Each approach will add an overlay so that a sophisticated portrait of the domain will emerge. The cumulative effect will be to reveal the domain in all its complexity.

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[2] When I played professor of psychology and was tempted to abandon my duties and go see a movie, I usually took Oscar Wilde's advice and succumbed to the temptation. However, I told myself that seeing the movie would help me in my work. It was a psychological movie - there were people in it. Now that I'm a professor of communication studies, I don't need any excuse to go see a movie. The movie is a medium, and there's communication in every movie.

FIGURE 1-3
NEWSPAPER ARTICLES ON PSYCOMM

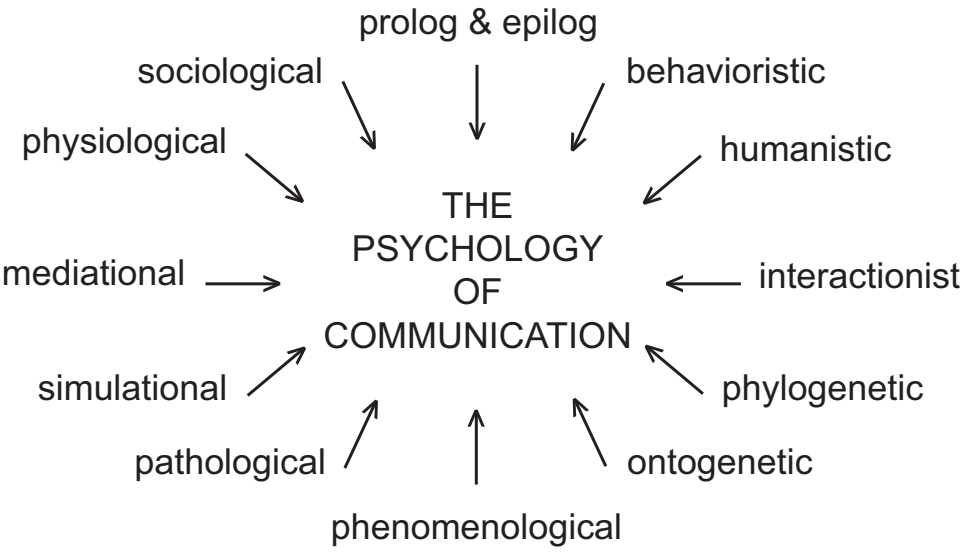

FIGURE 1-4
VARIOUS APPROACHES TO PSYCOMM

The chapters in the body of the book are organized around the various logical approaches to Psycomm.

The first three approaches are presented as thesis (behaviorism), antithesis (humanism) and synthesis (interactionism). Chapter 2 (behavioristic approach) considers only input information. Chapter 3 (humanistic approach) argues that we must consider stored information as well as input information. Thus, the same stimuli can produce different responses in different people because of their different stored information. Chapter 4 (interactionist approach) argues that we must consider fedback information as well as stored information and input information. Thus the behavior of a person is determined also by the feedback from their previous behavior. Those chapters present three more and more sophisticated concepts of the person and corresponding theories of communication.

Chapter 5 (phylogenetic approach) and chapter 6 (ontogenetic approach) place psychology firmly where it belongs as the study of organisms rather than of mechanisms. In tracing development from animal to human and from child to adult respectively, they demonstrate that growth is the progressive emancipation of the organism from the tyranny of the environment. How then can you do science when, despite your rigorous controls, your subjects do as they damn well please? 1

Chapter 7 (pathological approach) encounters the further complexity that the nervous system can have functional as well as structural disorders. Since it is the only system which "knows" its environment, there can be disorders of person-in-environment as well as disorders within the person. Chapter 8 (phenomenological approach) deals with the further complexity that the nervous system can be viewed from the inside (experience) as well as from the outside (behavior).

Chapter 9 (simulation approach) focuses on the various attempts to simulate communication using machines, notably the computer. Chapter 10 (mediational approach) focuses on the argument that computers are better used to extend the nervous system by intelligence amplification (IA) rather than to simulate it with artificial intelligence (AI).

Chapter 11 (biological approach) and chapter 12 (sociological approach) deal with the complexities arising from the fact that the nervous system is embedded in a hierarchy of systems within systems. There are subsystems within the nervous system which is, in turn a subsystem of the person, who is, in turn, a subsystem of various social groups.

When asked to account for the success of his famous lectures, Professor Alan Goldstein of Cornell University said "*I tell 'em what I'm going to tell 'em, I tell 'em, and then I tell 'em what I've told 'em.*" I'm telling you what I'm going to tell you here in Chapter 1 (Prologue), I'll tell you in the body of the book (Chapters 2-12), and I'll tell you what I've told you in Chapter 13 (Epilogue).

This textbook, like many textbooks, was written because I was teaching a course for which no textbook was available. Over the years while teaching the course, my lecture notes evolved into this book. In lieu of a textbook, I assigned a number of slim, inexpensive, well-written books within the domain of Psycomm. The nine books I have chosen over the years are presented in Figure 1-5. Once again, the variety of those books illustrates the ubiquity of Psycomm.

Six of those books are now out of print. Their publishers abandoned them when they could no longer be produced for a profit. This makes good sense in the business world. However, it does not make sense in the scholarly world to have access only to the books that sell. I'll try to retrieve those thrown-away books by incorporating some of their content here in this book.

FIGURE 1-5 ASSIGNED READINGS IN PSYCOMM

CHAPTER 2
BEHAVIORISM AND TRANSPORTATION THEORY

Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select – doctor, lawyer, artist, merchant-chief and, yes, even beggar-man and thief, regardless of his talents, penchants, tendencies, abilities, vocations, and race of his ancestors. I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years.

John B. Watson
Behaviorism, Page 82

2.1 IMPLICIT CONCEPT OF PERSON

Communication theory is almost invariably considered at the lofty sociological level of analysis. In communication studies - as in, sociology, economics, political science, and all the other social sciences - there is an underlying concept of the person. Apart from some vague, infrequent (and politically incorrect) reference to economic man, political man, etc., the concept of the person is usually implicit. I would like to make it explicit, and thereby offer this book as a complement to the usual analysis.

The next three chapters will explore three alternative concepts of the person - the behavioristic concept, the humanistic concept and the interactionist concept. They will be presented as thesis, antithesis, and synthesis [GARDINER 1980]. I will argue that the behavioristic concept of the person underlies traditional communication theory and practice, that the humanistic concept of the person underlies alternative communication theory and practice, and that the interactionist concept of the person promises more integrated theory and more meaningful practice.

The behavioristic concept of the person is presented as the system of five propositions listed below. Since each proposition implies the next, those five propositions constitute a system rather than simply a set.

- The person has only extrinsic needs
- The person is conditioned from the outside in
- The person is not responsible for behavior
- The person has only extrinsic worth
- The person has contractual relationships

The typical exposition of behaviorism consists of the first two propositions - “The person has only extrinsic needs” in courses on Motivation, and “The person is conditioned from the outside in” in courses on Learning. Propositions 3, 4, and 5, the (somewhat embarrassing) implications of those first two propositions, are not considered by behaviorists. They will be considered in Chapter 5, to contrast them with the equivalent propositions in the humanistic concept of the person, and to demonstrate how the interactionist concept of the person can be considered as the synthesis of the behavioristic thesis and the humanistic antithesis.

2.2 THE PERSON HAS ONLY EXTRINSIC NEEDS

The broad question in psychology is "What is the function of the nervous system?" and the broad answer provided by the theory of evolution is "To enable the organism to survive." The theory of evolution could thus be considered as the basic theory of psychology.[1]

The next question is How does the nervous system enable the organism to survive? and the classic answer is It ensures that the organism will approach things which are good for it (for example, things that it eats) and that it will avoid things which are bad for it (for example, things that eat it). The **need-reduction theory** explains the former mechanism and the **activation theory** explains the latter mechanism. Thus, the need-reduction theory and the activation theory could be considered as the means of fitting psychology within the basic framework of the theory of evolution. Let us look at each theory in turn。

You are alive. You are in a precarious state. Life is a narrow tightrope with death on either side. To stay alive, you must maintain yourself within a narrow range of temperature, blood-sugar concentration, metabolic rate, and so on. Let us focus on temperature.

You have been set by the great temperature-setter-in-the-sky at 98.6 Fahrenheit (or at 37 Centigrade if God has gone metric). You are allowed to vary a little bit around this optimal temperature. But, a bit too low, you die; a bit too high, you die. Certain physiological mechanisms enable you to maintain your optimal temperature despite variations in the temperature of your environment. If it gets too cold, you shiver; if it gets too hot, you sweat.

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[1] The question and the answer are both open to debate. However, since behavior and experience are manifestations of the function of the nervous system, I prefer to consider our other subsystems as internal environment. As for the answer, I think it is time to place psychology within biology where it belongs.

Consider, however, the alligator. It shivers not, neither does it sweat. Yet all alligators are not frozen alligators or boiled alligators. A group of alligatorologists organized an expedition to Africa to find out why. A few thousand miles and several thousand dollars later, they discovered the answer. When an alligator gets too warm, it slides into the cool water; when an alligator gets too cold, it climbs on to a hot rock. Thus, the alligator maintains its optimal temperature by adjusting the environment to itself rather than by adjusting itself to the environment. It behaves.

The process by which an organism maintains itself in its optimal state is called **homeostasis**. When it deviates from this optimal state, it can return to it either by adjusting itself to the environment or by adjusting the environment to itself. Our species, of course, uses both mechanisms. We shiver and sweat and we buy furnaces and air-conditioners. Adjusting ourselves to the environment is the province of physiology; adjusting the environment to ourselves is the province of psychology.

Let us take a closer look at the psychological mechanism. Imagine a hypothetical contented organism which has just been wined and dined. It is in its optimal state. However, it can not remain thus for long. The mere passage of time conspires against its bliss. It gets thirsty. It gets hungry. This physiological state of deprivation is called a **need**. The need can be satisfied by appropriate behavior with respect to some appropriate object in the environment - by drinking water in the case of thirst and by eating bread in the case of hunger. Since the nervous system is the only system within the organism which knows the environment, the physiological state of deprivation in the digestive system must be transformed into some psychological counterpart in the nervous system. A need must be transformed into a **drive**. The drive orients the organism to some appropriate thing in the environment - the **goal**. By making the appropriate response to the goal, the drive is removed, the need is satisfied, and the optimal state is regained.

Let us turn now from the positive to the negative drives, from the tendency to approach things that are good for us to the tendency to avoid things that are bad for us, from the need-reduction theory to the activation theory.

There are two ways we can avoid things that are bad for us. We can remove the thing or we can remove ourselves. The first involves fight and the second involves flight. The emotion underlying the former is rage

and the emotion underlying the latter is fear. Such primitive emotions must have played a dominant role in the early history of our species. Consider one of our remote ancestors confronted by a saber-toothed tiger. She has a tiger in her subjective map. She can remove it or remove herself. She can kill it or she can run away. The only good tiger is a dead tiger or a distant tiger.

An emotion-arousing stimulus has three broad effects - experiential (we feel angry or afraid), physiological (there are certain changes in our bodies), and behavioral (we fight or flee). Discovery of the function of a structure in the lower brain called the **amygdala** has clarified the interaction among those three effects.

The emotion-arousing stimulus, like all stimuli, acts directly on the cortex. The stimulus is transformed at the appropriate receptor (a set of cells specialized for this purpose) into nerve impulses, which are transformed at the appropriate projection area of the cortex (a set of cells specialized for this purpose) into a perception. This **cue function** of the stimulus has long been known. However, what is less known is that the emotion-arousing stimulus also acts indirectly on the cortex to perform an **arousal function**. It switches on the amygdala which projects diffusely on to the cortex, to alert you that something is happening in your environment.

Thus, the arousal function alerts you that something is happening (the amygdala responds in the same way to sights, sounds, tastes, smells, and touches) whereas the cue function informs you precisely what is happening. The arousal function prepares you for an emergency. It acts upward on the cortex to produce the experiential effects (fear or rage) and downward on the autonomic nervous system and the endocrine system (responsible respectively for the physical and chemical aspects of your internal environment) to produce the physiological effects (increased heart rate, injection of adrenaline, and so on), to provide the motivation and the energy for the behavioral effects (fight or flight).

The cue function informs you whether there is indeed an emergency. Most stimuli are not worth getting emotional about. In such cases, the cortex acts downward on the amygdala to inhibit the arousal function. Animals without a cortex get mad at every little thing. The cue function also informs you of the nature of the emergency so that you can respond appropriately. Otherwise, you might attack tigers and run away from rabbits.

The need-reduction theory and the activation theory are diagrammed together to clarify the similarities and differences between them (see Figure 2-1). Both theories involve a negative feedback loop to maintain the organism in its optimal state. Both theories describe the nervous

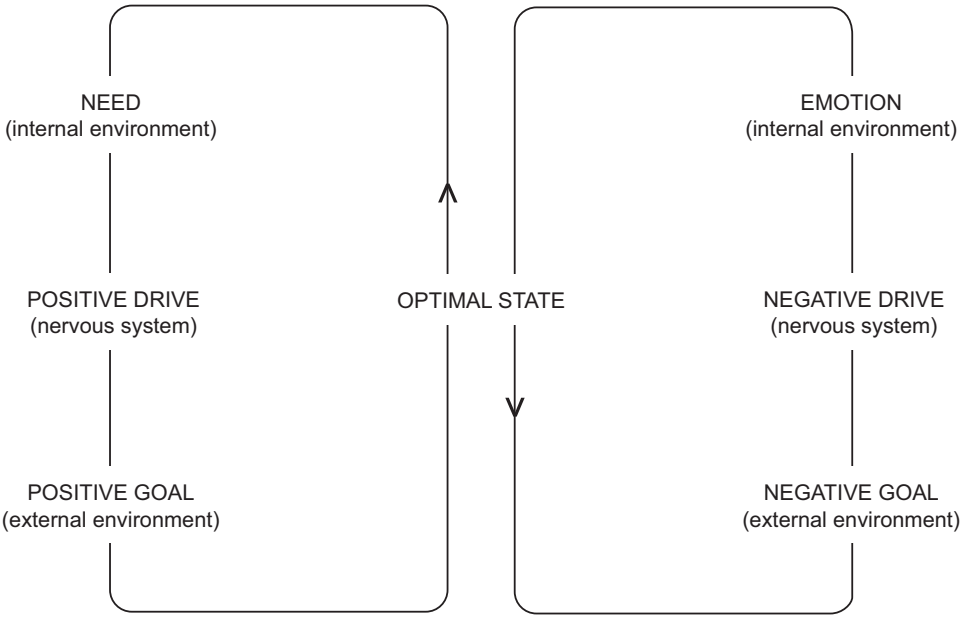

FIGURE 2-1
NEED-REDUCTION AND ACTIVATION THEORIES

system as a mediator between the internal environment (that is, the other subsystems within the organism) and the external environment. According to the need-reduction theory, the function of the nervous system is to mediate between a state of deprivation in the internal environment (need) and a thing in the external environment which will satisfy that need (positive goal), so that the organism will approach that thing; according to the activation theory, the function of the nervous system is to mediate between a thing in the external environment (negative goal) and a state of the internal environment (an emotion), so that the organism will avoid that thing.

Since the nervous system is merely a mediator between internal and external environments, the person is extrinsically motivated. The person is pushed and pulled by external forces - pushed by needs and pulled by satisfiers of those needs, pushed by threatening things and pulled by

emotions generated by those things. Behaviorists conclude that all human behavior is determined by those extrinsic needs.

Secondary drives can however he established through association with those primary drives. Thus, monkeys will work for tokens if those tokens can be exchanged for food. Capitalism is established by making money the means to the end of satisfying the basic biological needs. The behaviorist would thus explain your behavior in reading this book by saying that you are reading this book to pass a course to get a degree to get a job to get money to buy food to remove your hunger drive to satisfy your hunger need to return to your optimal state to survive.

2.3 THE PERSON IS CONDITIONED FROM THE OUTSIDE IN

CLASSICAL CONDITIONING (BASIC MODEL) - PAVLOV

It all began - so the story goes - when a great Russian physiologist walked into his laboratory and a dog salivated. Most of us would merely have been flattered and continued with our physiology. But Ivan Petrovich Pavlov was not like most of us. He recognized this reaction as an important phenomenon. Before this incident, Pavlov had been awarded a Nobel Prize for his work in physiology. Most of us would have been content with that. But Ivan Petrovich Pavlov was not like most of us. He began a 40-year study to discover the secret of the saliva and thus laid one of the cornerstones of psychology [PAVLOV]. Have you ever heard of Twitmyer? He was a graduate student in the United States when he stumbled on the same phenomenon before Pavlov, considered it footnote-worthy to his doctoral thesis, and went no further. Twitmyer was like most of us.

Environment affects behavior. This statement is true but trivial. Pavlov suggested how it may be made more precise and thus more meaningful. Representing a dog or a person or whatever organism as a rather unflattering empty box, we could consider environment as a set of stimuli acting on it and behavior as a set of responses produced by it. Now we

can substitute the precise statement "*Stimulus X elicits response Y"* for the vague statement "*Environment affects behavior"*. We all know that an organism can come to behave differently in the same environment. That is, it can learn. How does it learn? Or, more precisely, how can stimulus X, which was previously neutral, come to elicit response Y?

Pavlov begins his answer by pointing out that, at birth, some stimuli are already capable of eliciting certain responses. If I tap you sharply below your knee, then you will raise your lower leg. The tap (stimulus) is prewired to the raising of the lower leg (response). No experience necessary. Such a prewired link between a stimulus and a response is called an **unconditioned reflex (UCR)**.

If I blow a whistle, you will not raise your lower leg. However, if I were to blow the whistle, tap below your knee, blow the whistle, tap below your knee, blow the whistle, tap below your knee, and so on and on, then eventually you would raise your lower leg to the whistle alone. Such an acquired link between a stimulus and response is called a **conditioned reflex (CR)**. It is acquired by the operation of presenting a stimulus that was originally neutral - the **conditioned stimulus (CS)** - together with a stimulus that is already wired to the response - **unconditioned stimulus (UCS)**. This operation is called **classical conditioning**.

Pavlov continued to explore **extinction** - the process of "undoing" conditioning by presenting the conditioned stimulus without the unconditioned stimulus, **generalization** - dogs conditioning to a whistle of one tone are also conditioned to a lesser extent to nearby tones, and **differentiation** - dogs can be taught to differentiate between two tones.[2]

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[2] In one experiment, dogs failed to differentiate between two shades of grey. Pavlov taught them to differentiate between black and white. He then moved to two greys along the black-white dimension. When he got to the two original greys, the dogs could now differentiate them. He attributed this to the learning of the dimension along which they differ. By presenting behaviorism and humanism as the end-points of a dimension, I hope to enable you to differentiate between the various interactionist positions we will explore in this book.

CLASSICAL CONDITIONING (DE LUXE MODEL) - WATSON

Psychology was originally considered as the study of consciousness, but a dynamic young man swept onto the psychological stage and transformed it into the study of behavior. He left as abruptly as he arrived - into the world of commerce, where he worked as a door-to-door salesman and finally became vice-president of the company. In his foray into psychology, however, John B. Watson left a permanent mark. As a psychologist, he was a good salesman. He demonstrated that sometimes an overstatement is more valuable than a true statement. He wrote the manifesto of behaviorism [WATSON JO], and much of psychology since has been an extended debate about his thesis. Most psychologists even today could be considered as behaviorists, neo-behaviorists, post-neo-behaviorists or anti-behaviorists.

Watson argued that consciousness is unobservable and hence irrelevant to science. We must focus on observables - stimuli impinging on an organism and responses elicited from the organism - and find the functional relationships between them. He had to demonstrate how certain stimuli, previously neutral, came to elicit certain responses. He stumbled upon the work of Pavlov and, thus, Pavlov was adopted as the reluctant grandfather of behaviorism.

Watson extended Pavlov's model of classical conditioning to explain not only the learning of simple, local responses like salivation, but also complex, whole-body responses like fear. We have many fears, ranging from specific things - like the number 13 (triskaidekaphobia) and being stuck in chimney pots (Santaclaustrophobia) - to general things - like everything (panaphobia) or fear itself (phobophobia). We were not born with those fears. How did we learn them? By classical conditioning, said Watson, and he proceeded to demonstrate just how.

He introduced an 11-month-old infant named Albert to a white rat - whose age and name were not recorded [WATSON JO & RAYNER]. Albert made the appropriate 11-month-old responses to the rat - he reached for it and cooed at it. Albert liked white rats. Then Watson presented the rat a number of times, fiendishly arranging for his assistant, Rosalie Rayner, to make a terrifying noise behind Albert each time. The noise frightened Albert and made him cry. After a few repetitions of the rat and the noise together, Albert began to cry at the appearance of the white rat alone. Moreover, he began to cry at the appearance of a white rabbit, a ball of

cotton wool, a false beard, a man with a beard, a man who had accompanied a man with a beard - that is, at anything white and fluffy or at anything associated with anything white and fluffy.[3]

Behavior, however, does not consist of isolated responses, whether small or large, but a stream of responses. Watson explained that stream of responses which we call a habit as a chain of conditioned reflexes (**chain reflex**). As each response is made, a stimulus is fed back to the brain to inform it that the response has been made. The links in the chain are formed as each such fedback stimulus becomes classically conditioned to the next response.[4]

A certain subset of habits, involving the muscles of the larynx and throat, is the basis for speech. Talking is the moving of the muscles of the throat, just as walking is the moving of the muscles of the legs. Since talking to oneself out loud is frowned up, we do it in a small inner voice. Thinking is simply talking to oneself so that no one else can hear. Thus Watson attempted to explain all behavior in terms of classical conditioning. He was, of course, only partly right. He grasped some truth but not the whole truth. Classical conditioning determines some behavior but not all behavior. Let us turn to another kind of conditioning which also determines some behavior.

INSTRUMENTAL CONDITIONING (BASIC MODEL) - THORNDIKE

It is necessary to reset the stage for the next character in our cast. The theory of evolution placed us where we belong - with the other animals

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[3] Watson and Rayner did not extinguish this fear response. Does anyone know a twitchy old man called Albert?

[4] This theory may sound preposterous. However, many of our habits are this mechanical. Am I the only person who has gone into his bedroom to change his shoes, mechanically gone through the undressing chain reflex started with the response of taking off the socks, and found himself in bed? Am I the only person who can't type "ratio" without putting an "n" at the end? At first, I had a Freudian explanation about growing up living on “rations” during the war. I now realize that the sequence of responses *a t i o* is almost invariably followed by *n*.

on the same phylogenetic scale. This discovery has two implications: humans are seen as more animal-like and animals are seen as more human-like. The violent repercussions of the first implication are very familiar - Thomas Huxley versus Bishop Wilberforce, Scopes versus State of Tennessee. Let's briefly consider here the less familiar repercussions of the second implication.

Certain scholars begin to attribute human qualities to animals. They soberly collected anecdotes from retired colonels, minister's wives and other animal-lovers that demonstrated how ingenious animals were in solving problems. A typical anecdote describes how a field mouse got honey out of a narrow-necked jar by squatting on the rim, dipping its tail into the honey, and licking its tail. G. J. Romanes, the leader of this movement, the father of comparative psychology, the gossip columnist of the animal world, collected those stories in his book *Animal Intelligence* [ROMANES]. He concluded, on the basis of this anecdotal evidence, that animals are very intelligent.

Enter Edward L. Thorndike, a graduate student at Harvard University, arguing: Such anecdotes describe the behavior of an animal after it has learned. If one were to study the process rather than the product of learning, the animals would perhaps not appear so intelligent. Thorndike set out to study the process of learning in animals, by collecting a motley menagerie in his squalid room in a run-down boarding-house.

Enter Thorndike's landlady, the first villain of our story, lacking sympathy for the scientific spirit and throwing Thorndike and his animals out into the street. Enter William James, one of the greatest and kindest characters in the story of psychology, coming to the rescue by housing the menagerie in the basement of his own home and arranging for Thorndike to continue his research at Columbia University.

The rest of the story is history. Thorndike rounded up stray cats from the back alleys of New York City. He built a box with a door that could be opened by pressing a lever. Inside the box he placed a cat; outside the box he placed things that the cat liked (typically one or more of his famous three Fs - fish, friends, and freedom). The problem was to get out, and the solution was to press the lever.

When first put in the **puzzle box**, the cat went through its repertoire of responses: clawing at bars, hissing, arching its back, spitting and snarling, smiling at Thorndike, purring and meowing, and so and so on, more or less at random. Finally, by chance, it hit on the Thorndike-

ordained correct response. Each time it was put back into the box, it took less and less time to get out because it spent more and more time closer and closer to the lever and was thus more likely to trigger it by chance. Eventually it went immediately to the lever and pressed it.

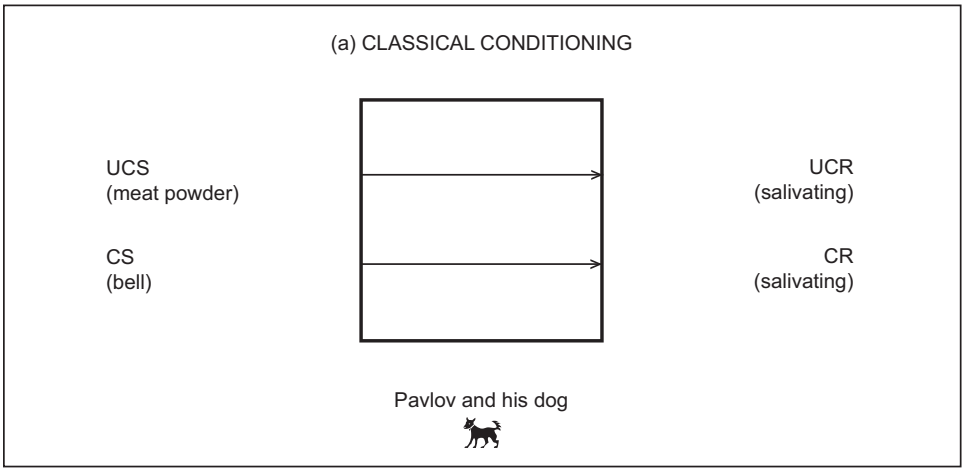
If Romanes had entered Thorndike's laboratory at this point, and watched the cat strolling nonchalantly over to the lever and casually pressing it, he would have run off to write yet another anecdote to show how very intelligent animals are. Thorndike, who had observed the mechanical process by which this apparently insightful product was established, knew otherwise. Romanes had written a book called *Animal Intelligence* describing how smart animals are; Thorndike now wrote his book also called *Animal Intelligence* demonstrating how stupid animals are [THORNDIKE].

In that book, Thorndike presented his now-famous description of **trial-and-error learning**. His theory of learning was somewhat analogous to the survival-of-the-fittest principle which is central to Darwin's theory of evolution. In a population of organisms, some are fitter to survive in a given environment; in a repertoire of responses, some are fitter to survive in a given situation. The fittest response is the one leading to reward.

When a response is followed by a reward, it is more likely to occur again (**law of effect**). In other words, the link between the stimulus situation and this reward-followed response is strengthened, and, since the total probability of all possible responses must add up to 1, the links between the stimulus situation and all the other responses are thereby weakened. Thus the fittest response survives and the other responses die.

Since all the responses are eventually followed by the reward, the law of effect must be supplemented by the **gradient of reinforcement**: the closer in time the reward to the response, the greater the strengthening effect. This principle implies that rats will learn the last turns in a maze first and the first turns last. Indeed they do. This principle implies that rats will run faster and faster in a straight runway as they approach the goal box at the end. Indeed they do.

Thus, we have a second answer to the question "*How does a particular stimulus, previously neutral, come to elicit a particular response?* " The response is a means of gaining access to a stimulus that already elicits some response that is intrinsically rewarding. This is **instrumental conditioning**. The two types of conditioning are seen in contrast in Figure 2-2.



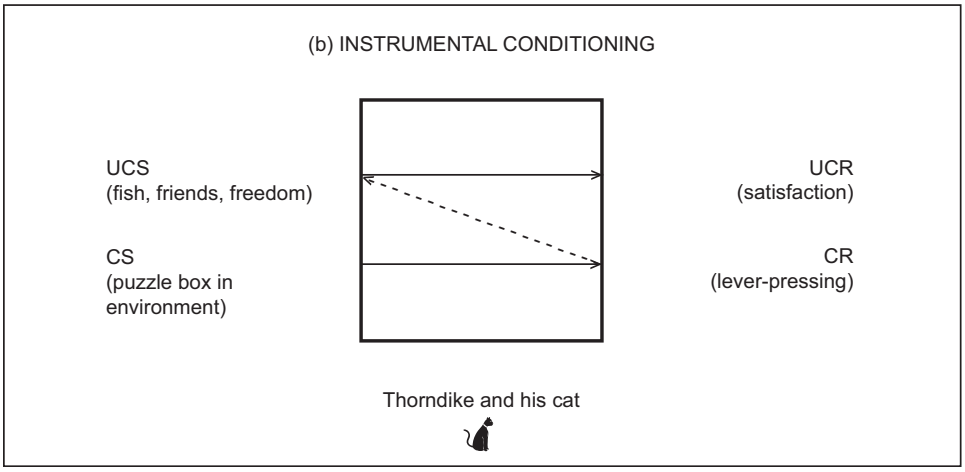


FIGURE 2-2
CLASSICAL AND INSTRUMENTAL CONDITIONING

INSTRUMENTAL CONDITIONING (DE LUXE MODEL) - SKINNER

As the most famous exponent of pure behaviorism, B. F. Skinner is seen by many lay people as a sinister ogre scheming to manipulate their behavior. They see him as Big Brother watching them. The publication of his novel, *Walden Two*, enhanced this reputation [SKINNER 1960].

He described a utopian society, a sort of benevolent *Brave New World* - based on his conditioning techniques. In today-the-community-tomorrow-the-world fashion, he has argued convincingly in a later book, *Beyond Freedom and Dignity* [SKINNER 1972], that the problems of our planet can be alleviated by the appropriate application of those conditioning techniques.[5]

Skinner transformed Thorndike's puzzle box into what has come to be called, in his honor and to his dismay, the **Skinner box**. It contains a lever and a tray arranged so that pressing the lever permits a food pellet to drop into the tray. The index of learning in the Skinner box is the number of times the lever is pressed per unit of time, rather than, as in the puzzle box, the time to get out of the box.

Originally the rewards were dispensed and the responses were recorded by Skinner himself. Now, however, the Skinner box has become completely automated, and the rat can run its own experiment without the aid of an experimenter. When the lever is pressed, two metals surfaces make contact, a circuit is completed, a disk turns, and a pellet drops into the tray. Thus the rewards are dispensed. When the bar is pressed, a pen pressed against a tape moves up one notch. Since the tape is moving horizontally at a constant speed, the pen leaves a **cumulative record** of the number of bar presses per unit of time. Thus the responses are recorded.

Total automation is prevented only by the fact that the rat must be taught to press the lever. This is done by a process called **shaping**, using the **method of successive approximations**. The rat glances toward the lever. Give it a pellet. It looks at the lever. Give it a pellet. It takes a step toward the lever. Give it a pellet. It sniffs the lever. Give it a pellet. It raises its paw in the direction of the lever. Give it a pellet. Each response

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5 *Walden Two* was possibly written more as a literary exercise than a social program. (Skinner frankly admits to being a frustrated novelist who turned to psychology when he found out that he had nothing to say.) Any twinkle you may have caught in Skinner's eye is more likely to be caused by the thought of his next witty and incisive article than by any thought of controlling your behavior. He defended his extreme position against his many critics with vigor and charm (I'm tempted to say "*with freedom and dignity* "). We have nothing to fear from this courtly and responsible man. However, some people have indeed formed a community based on the principles expounded in *Walden Two* , and one of its founders has documented their first five years of trials and tribulations [KINKADE]. Cat Kinkade died in 2008 but her community lives on.

that is a successively closer approximation to the desired response is rewarded, until the rat is pressing the lever and supplying its own pellets.

At first Skinner arranged for the rat to get a pellet every time it pressed the lever (**total reinforcement**). However, he got tired of making so many pellets and decided to give the rat a pellet only some of the times it pressed the lever (**partial reinforcement**). In this way he stumbled inadvertently into a more true-to-life situation. The fisherman does not get a bite every time he casts his line, the saleswoman does not make a sale every time she delivers her sales pitch, and the suitor does not get a date every time he asks. We live in a world of partial reinforcement.

Schedules of reinforcement may be **ratio schedules** or **interval schedules**. That is, reward may be a function of response or of time - a pellet may drop after every 20 bar presses or after every 20 seconds. Schedules of reinforcement may also be **fixed schedules** or **variable schedules**. That is, a pellet may drop after every 20 presses or every 20 seconds, or after, on the average, every 20 presses or every 20 seconds. Ratio schedules tend to produce a higher rate of responding than do interval schedules, and variable schedules tend to produce a higher rate of responding than do fixed schedules. Thus rats work better on piecework than on salary and when they are paid sporadically rather than regularly. The most powerful schedule of all - the variable ratio schedule - is used in gambling casinos to produce a high rate of feeding coins into one-armed bandits and in homes to produce a high rate of crying in babies.

Skinner boxes have been adapted to an number of purposes. There is the gigantic Skinner box to contain all Skinner boxes the utopian society portrayed by Skinner in *Walden Two*. There are Skinner boxes for babies - in which they can be raised in a well-regulated environment (untouched, add Skinner's critics, by human hands). There are Skinner boxes for schizophrenics. A bare room is fitted with a lever and a cup so that, on pressing the lever, a reward (cigarette, candy, or whatever the patient likes) falls into the cup. Hopeless schizophrenics, who have not done anything for themselves for decades, will work hard for such goodies and thus take a small step back toward caring for themselves again. There are Skinner boxes for students - the much-discussed **teaching machines**. Since none of us are babies, few of us are schizophrenics, but all of us are students, let's focus on the teaching machine.

Let's focus, more specifically, on the teaching program, since the teaching machine is merely a mechanical device for presenting, in order, the set of frames of which the program is composed. We are interested in

the radio script rather than in the radio. The program consists of a series of statements and questions to which the students make some response. They then turn to the next frame to check whether the answer is correct and read the next set of statements and questions.

The situation is analogous to that of the rat in the Skinner box. The response is writing the answer rather than pressing the lever. The reward is learning that the response is correct rather than receiving a food pellet. The various principles in designing a program are derived from work with rats in the laboratory. The principle that the reward should follow as soon as possible after the response is a direct application of the gradient of reinforcement. The principle that each frame should go only a little beyond the previous frame is a direct application of the method of successive approximations.

B. F. Skinner once found himself sitting at a banquet next to the great philosopher Alfred North Whitehead and launched into an enthusiastic exposition of his project to explain all behavior in terms of conditioning. The calm old philosopher listened benignly to the brash young scientist. He conceded that non-verbal behavior may possibly be explained in terms of conditioning but not verbal behavior. By way of example, he challenged Skinner to explain, in his terms, why Whitehead chose at that moment to say "*No black scorpion is falling on this table*".

The next morning, Skinner began his book *Verbal Behavior* [SKINNER 1957], in which he presented the following response to Whitehead's challenge. Verbal behavior is behavior reinforced through the mediation of other people. There are two ways in which Skinner could have got the salt at that famous banquet - reaching for it himself (non-verbal behavior) or by asking Whitehead to pass it to him (verbal behavior). We use words then to gain reinforcement through the mediation of other people. This answer would appear to be very far from meeting Whitehead's challenge. Skinner argues, however, that the scientist is not required to explain each specific event within the domain of the science, but only the general principles underlying the specific events. The physicist is not expected to predict the order in which leaves will fall from a tree and the pattern they will form on the ground, but only to provide the general laws governing falling bodies.

Thus Skinner attempts to explain all behavior in terms of instrumental conditioning, just as Watson tried to explain all behavior in terms of classical conditioning. He, like Watson, is only partly right. He too has

grasped some truth but not the whole truth. Instrumental conditioning determines some behavior but not all behavior.

2.4 TRANSPORTATION THEORY OF COMMUNICATION

The theory of communication associated with the behaviorist concept of the person is the **Shannon-Weaver model of communication** [SHANNON & WEAVER]. Information is transmitted by a source over a channel to a destination. For example, right now I am the source, you are the destination, and we are communicating over the visual channel. The information transmitted by the source is not necessarily the information received by the destination. You may receive information which I did not transmit (**noise**) and I may transmit information which you do not receive (**equivocation**). The criterion of success is the percentage of **transmitted information** - that is, the overlap of information transmitted by source and information received by destination (see Figure 2-3).

Let us say that you know my last name is GARDINER but you do not know my first and middle names. If I now tell you that my last name is GARDINER, I provide you with no information. You already knew this. Information from the source (in this case, me) to the destination (in this case, you) is thus a function of **uncertainty** at the destination. Let us now say that I tell you my first name is WILLIAM. I provide you with information, since you did not already know this. Let us now say that I tell you my middle name is LAMBERT. Once again, I provide you with information because you did not already know this. However, I provided you with more information when I told you that my middle name was LAMBERT than when I told you my first name was WILLIAM, because there was more uncertainty at the destination. That is, you were more likely to guess that my first name was WILLIAM (every Tom, Dick, and Harry is called WILLIAM) than to guess that my middle name was LAMBERT.

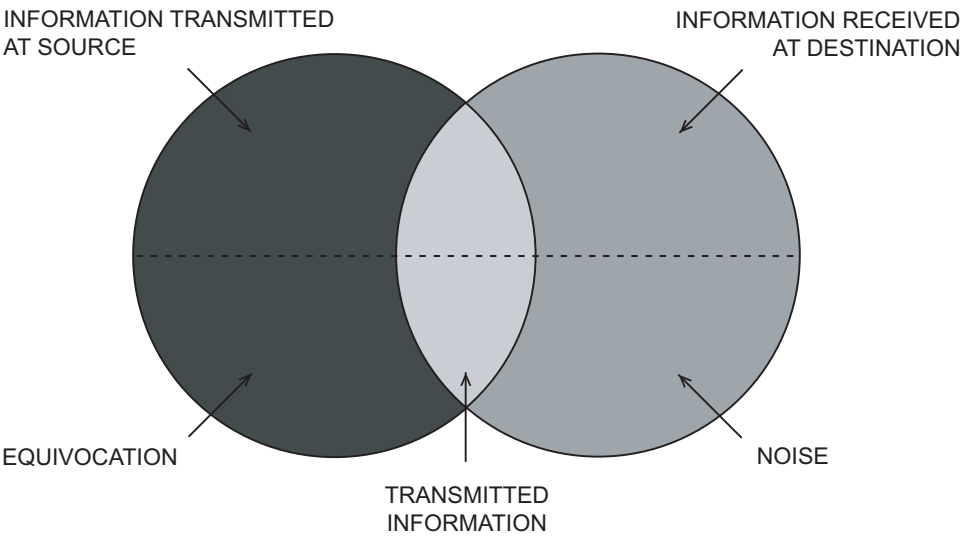

FIGURE 2-3
INFORMATION AT SOURCE AND AT DESTINATION

The amount of information transmitted from the source can thus be measured as a function of the amount of uncertainty at the destination. Information theorists define the **bit** (**bi**nary uni**t**) as the amount of information which cuts uncertainty in half. Thus, if I toss a coin and tell you that it came down HEADS, I transmit 1 bit of information because there were 2 equally likely alternatives - HEADS and TAILS. With 4 equally likely alternatives, then, I transmit 2 bits of information; with 8, 3 bits; with 16, 4 bits; and so on. The amount of information when told the results of tossing a die is between 2 and 3 bits, of choosing a letter from the alphabet is between 4 and 5 bits, of choosing a card from a pack is between 5 and 6 bits (see Figure 2-4).

In real life situations, however, letters of the alphabet are seldom equally likely. The likelihood of each letter is a function of the context in which they are found. Claude Shannon illustrates this in the **Shannon Guessing Game**. I am thinking of a four-letter word - guess the first letter. After some time, let us say you guess correctly that it is a Q. Now guess the second letter. You immediately guess correctly that it is a U. The second guess was easier because you had a context - in English, Q is always followed by U. Now guess the third letter. Once again, this is easier than guessing the first letter but harder than guessing the second letter, because the context reduces the options to the vowels. Let us say, you guess correctly that it is an I. Now guessing the fourth letter is easy

because there are only a few letters which added to QUI creates an English word. The word by the way was QUIZ.

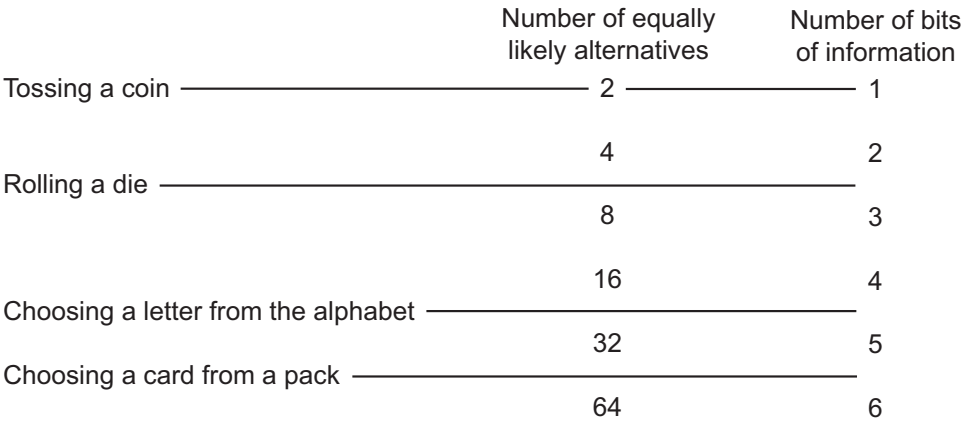

FIGURE 2-4 INFORMATION MEASURED IN BITS

Shannon was illustrating the fact that a language does not consist of a random series of letters which are equally likely but provides a context in which certain letters are more likely than others. This feature of language is called **redundancy** and explains why we are able to understand one another even although some of the information which is transmitted by the source is not received at the destination. We can fill in the gaps. As we gain more and more competence in a language, we can fill in bigger and bigger gaps.

CHAPTER 3
HUMANISM AND TRANSFORMATION THEORY

3.1 THE PERSON HAS INTRINSIC NEEDS

3.2 THE PERSON GROWS FROM THE INSIDE OUT

3.3 TRANSFORMATION THEORY OF COMMUNICATION

Education is learning to grow, learning what to grow toward, learning what is good and bad, learning what is desirable and undesirable, learning what to choose and what not to choose.

Abraham Maslow
The Farther Reaches of Human Nature

The humanistic concept of the person is presented as the system of five propositions listed below. Once again, since each proposition implies the next, those five propositions constitute a system rather than simply a set. Note that each of the five propositions negates the corresponding proposition in the behavioristic concept of the person. The two concepts are presented side-by-side in Figure 4-1.

- The person has intrinsic needs
- The person grows from the inside out
- The person is responsible for behavior
- The person has intrinsic worth
- The person has intimate relationships

3.1 THE PERSON HAS INTRINSIC NEEDS

Your nervous system is an element of you as a person and you as a person are, in turn, an element of your society. The nervous system has a very special role within this hierarchy of systems within systems, since it is the only system which can *know* your environment. It must know your environment in order to perform three broad functions - to mediate between your internal environment and your external environment (biological function), to interact appropriately with other people (sociological function), and to understand your environment and yourself (psychological function). Underlying each of those functions are certain organic needs - biological, sociological, and psychological, respectively - designed to ensure that your nervous system performs each of those functions.

In a previous book [GARDINER 1987], I presented a model which evolved out of a case we worked on at GAMMA, a Montreal-based think tank. In this model, the person is seen as the triple overlap of **ecosphere** (natural world), **sociosphere** (social world), and **technosphere** (artificial world). The nervous system has to deal with all three worlds - that is, satisfy biological (ecosphere), sociological (sociosphere), and psychological (technosphere) needs. This **triad model** is presented in Figure 3-1.

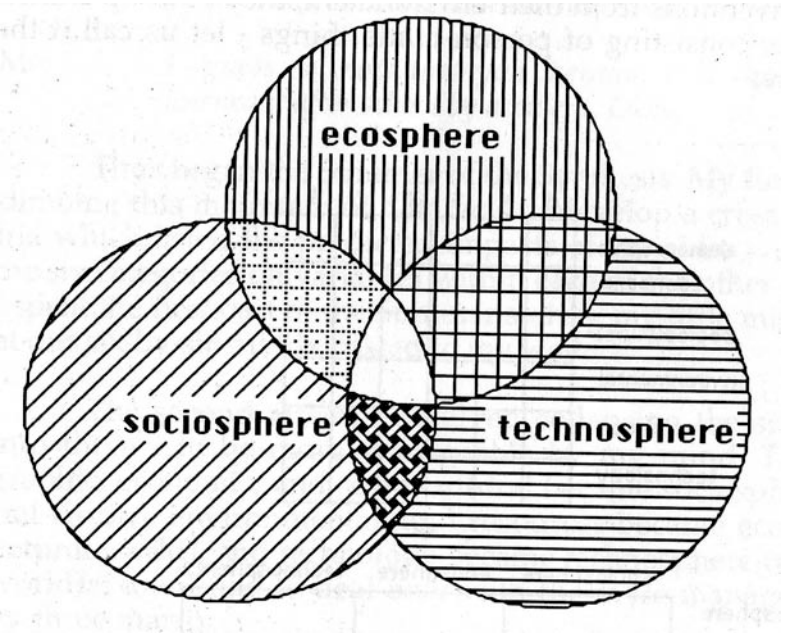

FIGURE 3-1 TRIAD MODEL

The biological needs and the means by which the nervous system satisfies them were described in the previous chapter. Need-reduction and activation theories explain how the nervous system mediates between your internal environment and your external environment to approach things which are good for you and to avoid things which are bad for you. No evidence for biological needs was presented. No evidence is necessary. The best evidence for a need is that failure to satisfy it results in damage to the organism. If an organism is deprived of food and water, it dies. Death is the dramatic documentation of the biological needs of hunger and thirst.

Humanism does not dispute the existence of biological needs nor the behavioristic explanation of how they are satisfied. The humanistic concept of the person does not replace the behavioristic concept of the person (as Copernicus's theory replaced that of Ptolemy) but subsumes it (as Einstein's theory subsumed that of Newton). That is, humanism accepts behaviorism as far as it goes but argues that it does not go nearly far enough. There are indeed biological needs built into the nervous system, but there are also sociological and psychological needs.

Since deprivation of sociological needs results in less dramatic damage to the organism than death, let us present some evidence here for their existence.

Whereas biological needs are designed to ensure the survival of the individual, sociological needs are designed to ensure the survival of the species. Mother Nature loads Jack and Jill with hunger and thirst drives so that they will each survive as individuals, but she also loads them with sex drives so that we will survive as a species. Since an organism can survive without sex - a sad organism but a live organism - we tend to assume that the sex drive is less powerful than the hunger drive. However, Mother Nature is more concerned with the survival of the species than with the survival of the individual, and would thus provide a powerful drive as a means to this end. Like many mothers, she wants to be a grandmother!

The sex drive ensures not only that Jack and Jill will get together for that delightful experience, designed to bribe us to procreate, but to stay together during the long period of infant dependency to care for the resultant offspring. This caring mechanism is built into the child during this period so that it will, in turn, care for its children. Our cooperation with other people is founded on this caring mechanism established within the family. It is cooperation rather than competition which has enabled our puny species to become, for better or worse, the King of the Jungle.

Total deprivation of sociological needs, like deprivation of biological needs, also results in death. The human infant is so dependent that it could not survive without the care of other people. The few dubious reports of feral children raised by animals indicate that, even if this is possible, they become more like the animals that raised them than the humans who bore them. Later we will meet such a feral child and find that this "noble savage" was more savage than noble.

Harry Harlow has studied the effect of total social deprivation on our close cousin, the Rhesus monkey [HARLOW]. Such deprived infants become highly neurotic, spending most of their time huddled in a corner of their cage. René Spitz has studied the effect of partial deprivation of sociological needs on human infants [SPITZ]. Many orphans, raised in foundling homes with minimum social contact, simply die. Those who survive are physically, emotionally, and intellectually stunted. They die a little bit. They fall somewhat short of becoming fully human.

The psychological needs, unlike the biological and sociological needs, are not primarily concerned with survival. Our species is nature's

de luxe model with trimmings beyond those necessary for mere survival. We have more needs than we *really* need. The psychological needs reflect organic potentiality rather than organic requirements. They enrich rather than simply maintain life, they ensure that we thrive rather than merely survive; they make us competent in our environment rather than simply adapted to it.

Studies of **sensory deprivation** suggest that there is a need for stimulation [HERON]. Undergraduate students at McGill University were hired, at 20 1956 dollars a day, to lie in a comfortable bed doing nothing. They had visors over their eyes, pillows around their ears, and cuffs on their arms, so that nothing would disturb their leisure. Those who accepted the invitation into this paradise for students were soon clamoring to get out. Such sensory deprivation turned out to be a very disturbing experience. Their thought processes deteriorated, their emotional responses became childish, and they had terrifying hallucinations. It seems that the mind needs stimulation just as the body needs food.

This need for stimulation persists even when you are asleep. The discovery that **rapid eye movements** accompany dreaming has enabled psychologists to do objective studies of this subjective state. Nathaniel Kleitman awakened subjects every time they started dreaming during several successive nights [KLEITMAN]. On subsequent nights, when they were allowed to rest in peace, they dreamed significantly more than before. When you are deprived of eating, subsequently you eat more; when you are deprived of dreaming, subsequently you dream more. You have a need to eat; you have a need to dream. We need sensory stimulation day and night.

The satisfier of the need to eat is food; the satisfier of the need for stimulation is novel stimuli. Just as you seek food when you are hungry, you seek novel stimuli when you have a need for stimulation. A number of studies have demonstrated that organisms explore and manipulate their environment in search of novel stimuli. Rats will often choose the long, scenic route over the short, dull route from the start to finish boxes within a maze. They spend more time around unfamiliar than familiar objects when they are placed in their cage. Monkeys will work hard to unfasten latches to open windows to see what's happening outside. Indeed, they will work hard to see nothing. They enjoy learning to open latches as an end in itself. The activity is its own reward. One psychologist tried to study monkeys through a keyhole in their room. All he saw was one large, brown, baleful eye. A monkey was studying him!

This need for stimulation may perhaps be explained in evolutionary terms. As long as things remain the same, you are in no danger. It is only novel stimuli which are potentially dangerous.[1] Exploration and manipulation of the environment makes the unfamiliar familiar. If it is indeed dangerous, then you can remove it or remove yourself; if is is not dangerous, then you have removed the threat of danger.

Besides removing danger or threat of danger, exploration and manipulation incidentally enables you to get to know your environment. One peculiar property of novel stimuli may help explain why we have come to know more than we really need to know in order to merely survive. As we explore and manipulate a novel stimulus, it becomes less and less novel, and therefore less and less able to satisfy the need for stimulation. We must continually search for new stimuli in order to satisfy this need.

Perhaps this helps explain how such luxury needs evolve. As our environment got less and less threatening, then the incidental function of getting to know the environment got more and more important. The luxury needs thus evolved our of survival needs. We need to know our environment in order to survive in it but, as the threat to survival decreased, we needed to know our environment simply in order to know our environment. Psychological needs were means to an end but became ends in themselves. This process is called **functional autonomy**.

Psychologists once arranged to have observers infiltrate an organization whose members believed that the world would end at a particular time on a particular date. They were curious to discover what happened when that time came and went and the world remained. They found that those members of the group who were only peripherally involved ceased to believe, whereas those members who were strongly committed to the group (that is, those who had stated their beliefs in interviews with the press, who had sold their possessions, who had cancelled their life-insurance policies, and so on) continued to believe. Those true believers argued that the destruction of the world had been postponed, that there had been a mistake in the date, that the apocalypse had been cancelled because of their vigilance, and so on.

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[1] I once developed a Scale of Technophobia for the Department of Communications of the Canadian Federal Government only to find that it was actually a Scale of Neophobia. What was feared was not technology but new things. It just happens that recently most new things have been new technologies.

Leon Festinger, the leader of the group of psychologists, explained those findings as **cognitive dissonance** [FESTINGER ET AL]. When two items of information do not fit, there is a tendency for one of them to be changed. For example, the two items of information - *I smoke* and *smoking causes cancer* - are dissonant. Festinger found indeed that significantly fewer smokers than non-smokers believed that smoking causes cancer. People, with those two dissonant items in their subjective maps, either stop smoking or stop believing.

Rather than spending hundreds of hours and thousands of dollars doing research, your grandmother could have told you that right away for nothing. However, research on cognitive dissonance has lead to a number of findings which your grandmother would not have predicted:

- Not only do we own a car because we read ads for it, but we later read ads for it because we now own it,
- Not only do we say what we believe, but we come to believe what we say,
- Not only do we own things which we like, but we come to like things which we own,
- Not only do we know what we like, but we come to like what we know.

All of those findings point to a need for consistency.

Whereas the need for stimulation provides the organic basis for knowing our environment, the need for consistency provides the organic basis for understanding our environment. Not only do we need to know, but we need to know what we need to know. What we know must be organized into a consistent body of knowledge. That is, we need not only to know but to understand. The need for stimulation and the need for consistency thus provide an organic basis for psychological growth. As we will see in Section 6.3, Jean Piaget describes the process of mental growth as a series of alternating assimilations and accommodations. You assimilate information from your objective world and adjust your subjective map to accommodate that information if it does not fit. The need for stimulation is the organic basis for assimilation, and the need for consistency is the organic basis for accommodation. The need for stimulation ensures a fresh supply of new information from the objective world, and the need for consistency ensures that this information will be integrated into a consistent subjective map of that objective world.

The shift from a behavioristic to a humanistic concept of the person is, thus, at its foundation, the shift from **extrinsic motivation** to **intrinsic motivation**. The evidence above leaves little doubt that the need

to know and to understand our environment and ourselves is built into the nervous system of our species. There is no need, therefore, for some elaborate system of rewards and punishments to bribe and threaten us into knowing and understanding. Indeed, it is surprising that the burden of proof is on those who advocate intrinsic motivation. The basic characteristic of an organism, as opposed to a mechanism, is that it is intrinsically motivated. No mother of a two-year-old child requires any experimental evidence that our species, the most intrinsically motivated of all, will explore and manipulate the environment without rewards and *despite* punishments.

3.2 THE PERSON GROWS FROM THE INSIDE OUT

If the person has intrinsic needs, then the person grows from the inside out. Every normal child has the potential to be fully a person, just as every normal acorn has the potential to be fully an oak tree and every normal kitten has the potential to be fully a cat. Powered by the intrinsic system of needs, built into the nervous system, as described above, the child seeks satisfaction for them. In an appropriate environment, children are able to satisfy those needs and thus fully realize the human potential. The basic project of the child is to become an adult - not any old adult but a great and good adult. We therefore need to *explain* not the genius of Albert Einstein or Margaret Mead (or whoever you think has most fully realized the human potential) but rather why we are not *all* Einsteins or Meads. Why are most of us stunted?

Abraham Maslow argues that, although the biological, sociological, and psychological needs must all be satisfied by the same nervous system, they are naturally in harmony. The needs are organized in a hierarchy [MASLOW 1954].[2] Biological needs are most potent; when they are satisfied, sociological needs become most potent; and, when

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[2] My hierarchy is a simplification of Maslow's hierarchy, in which needs are clumped into three broad categories - biological, sociological, and psychological. His highest need - self-actualization - is considered here as the realization of the full human potential, which involves satisfaction of all those sets of needs.

those are satisfied, psychological needs, in turn, become most potent. That is, you shift gears up the **hierarchy of needs** as lower needs are satisfied. We get stunted when we fail to shift gears up this hierarchy of needs [MASLOW 1963].

The biological needs and the sociological needs are easily satiated so that, in a healthy person in a healthy society, most time is available for the pursuit of satisfaction of the insatiable psychological needs. Eating ruins your appetite. The satisfiers of sociological needs - namely, other people - are in plentiful - indeed, too plentiful - supply. The satisfaction of the survival needs provides pleasant periodical interludes from the rigors of satisfying the psychological needs. Perhaps psychological needs, which enable us to thrive rather than merely survive, can best be seen in terms of surplus energy just as economic luxuries can be seen in terms of surplus capital.

Most of the people on our planet spend most of their time struggling to satisfy the survival needs and thus have little *spare time* for the luxury of satisfying the psychological needs of knowing and understanding. Affluent people like ourselves have little experience of a subjective map in which biological needs are prepotent. We get an occasional glimpse of such a world when hungry and note that we are highly sensitive to stimuli relating to food.

A psychologist who flashed nonsense syllables on a screen just before lunch at a convention got a significant number of food-related responses. Volunteers in an experiment on the effects of semi-starvation reported that their consciousness became dominated by food. They talked about food, dreamed about food, replaced the pinups in their lockers with photographs of food, and exchanged recipes rather than jokes with the other volunteers. An anthropologist reports that food dominates the unconscious lives of members of an African tribe for whom food is scarce [RICHARDS]. We are dominated not by sex, as Freud argued, but by whatever is scarce. Sex was what was scarce in Victorian Vienna. The famished man does indeed live by bread alone.

While I was author-in-residence at Brooks/Cole Publishing Company in Monterey, California, we helped the widow of Abraham Maslow publish a posthumous collection of his unpublished papers [MASLOW 1979]. Among his papers, we found a note from Ruth Benedict, who was a teacher of Abraham Maslow (and, incidentally, one of the few people he had met that he considered a self-actualized person).

Ruth Benedict, an anthropologist, puzzled for years about the essential difference between those societies which she liked and those societies which she did not like. She finally concluded that, in the societies she liked, the ends of the individual and the ends of society tended to be synergetic, whereas, in the societies she did not like, the ends of the individual and the ends of society tended to be antagonistic. The note described this distinction between **synergetic** and **antagonistic societies**. Maslow used this distinction in his consideration of what he saw as our two basic problems - that of the good person and that of the good society [MASLOW 1964].

One factor which stunts our growth is that we live in an antagonistic society. He argued that, whereas Western philosophers (whether Hobbes with his bad person controlled by good society or Rousseau with his good person corrupted by bad society) tend to view the ends of the person and the ends of society as antagonistic, there is no reason why they can not be synergetic. Society is a social invention and we may as well invent a good one, in which what is good for society is also good for the person and what is good for the person is also good for society. The good society is one which provides the means of satisfying the true needs of the person and the good person is one who has those true needs satisfied. The good person is created by the good society and the good society is composed of good people.[3]

The view of the relationship between the person and society tends to be an extension of the view of the relationship between one person and another (the little society of two). In Section 4-6, we will argue that the behaviorist views human relationships as contractual, whereas the humanists views human relationships as intimate. Those who view interpersonal relationships as contractual tend to view the relationship between the person and society as antagonistic: those who view interpersonal relationships as intimate tend to view the relationship between the person and society as synergetic.

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[3] I feel almost embarrassed to talk of the good person - it is so unfashionable. Hearing of a man who lived with Genevieve Bujold, a beautiful and talented actress, I wondered why he was worthy of such a fine woman. Why him and not me! He was pointed out to me in the street. He had a kind face but - no - he was not magnificently handsome. He was introduced to me. His conversation was lively but - no - not brilliant. He took me to his home. It was comfortable but - no - not the home of someone who was fabulously wealthy. As I got to know him better, I gradually realized that he was simply a good person. It is a sad comment on me and my times that it took me so long to consider this possibility.

In Chapter 8, we will explore a darker view of why we are so stunted. The process of human growth is so long and so complex that many things can go wrong. Whereas it is relatively easy for an acorn to become an oak tree and for a kitten to become a cat, it is not so easy for a child to become fully human. The theory of Sigmund Freud could be considered as the dramatic documentation of the many things which can go wrong.

His id, superego, and ego represent the forces striving for satisfaction of biological, sociological, and psychological needs, respectively. Although, as argued above, those three forces are naturally in harmony, Freud demonstrates how they can come into conflict.

Since the ego tries to maximize truth (the **reality principle**) and the id tries to maximizes pleasure (the **pleasure principle**), they come into conflict when truth and pleasure are incompatible. In summarizing scientific findings about human behavior, two psychologists describe the person as a *creature who adapts reality to his own ends, who transforms reality into a congenial form, who makes his own reality.* [BERELSON & STEINER]. It seems that, in the conflict between pleasure and truth, pleasure usually wins.

Since the ego is concerned with laws (propositions created by humans to describe their environment) and the superego is concerned with rules (propositions created by humans to prescribe their conduct), they come into conflict when laws and rules are incompatible. Studies of conformity suggest that, in the conflict between laws and rules, rules usually win.

According to Freud, the attempts by the ego to know and understand our world and ourselves is continually sabotaged by the id chanting *I want* and the superego preaching *thou shalt not*. Any accuracy in our subjective maps of the objective world is a limited, hard-earned, and precarious accomplishment. This will remain the case unless we can build a world in which truth is invariably pleasant and rules are invariably rational.

3.3 TRANSFORMATION THEORY OF COMMUNICATION

In the early 1970s, a number of communication theorists argued that the “destination” is not passive but actively involved in the communication process. In *The Responsive Chord,* Tony Schwartz argues that to reach a person and motivate him or her to respond to your message requires more than empirical facts and special effects. Your message must "resonate" with the person, striking that "*responsive chord*" by connecting and touching your audience's whole matrix of beliefs, cultural identifications, opinions and values [SCHWARTZ]. In *Mythologies,* Roland Barthes considers communication in the light of the myths shared by the “source” and the “destination”, demonstrating that advertisers tune in to the myths in the minds of consumers [BARTHES]. In *Message in the Bottle*, Walker Percy argues that communication can not be understood as a dyadic event involving just source and destination but must involve a third factor namely the meaning that they may or may not share [PERCY].

Marshall McLuhan and Barrington Nevitt argue that information is not simply transported from source to destination but is transformed at the destination [MCLUHAN & NEVITT]. Thus, whereas the behavioristic concept of the person underlies the traditional **transPORTation theory of communication**, in which information is simply transported from the source to the destination, the humanistic concept of the person underlies an alternative **transFORMation theory of communication**, in which the information is transformed at the destination.

The transportation theory of communication, based on the behavioristic concept of the person, assumes that the audience is passive. S/he is a couch potato - all eyes but no action. The big television networks tend to view their task cynically as delivering a passive audience to their advertisers, with the programs between the ads merely a device to keep them watching. They talk about capturing eyeballs and putting bums in seats. Critics of television tend to agree with this vision of the audience, and see themselves as condescending to save the slobs from themselves.

There has been, until recently, some justification for this point of view. If no action is possible, except switching to another almost identical

channel or, in extreme cases, switching the television off, then the audience is necessarily passive.[4]

However, recently we have had the revolt of the couch potato - remote control, VCR, interactive videodisk, desktop video production. Such new technologies promise to transform the passive couch potato into an active producer-director programming his/her own evening of enlightenment and entertainment.

The shift from a behavioristic to a humanistic concept of the person is part of a larger shift which is currently taking place. We all know of the shift from an industrial society, based on energy, to a post-industrial society, based on information. This revolution is over and what is happening now is that people are considering the implications of this shift for particular institutions and individuals.

One major implication for we scholars is the shift from physics (study of energy) to biology (study of information) as the basic discipline. In the era of physics, the basic model was the mechanism; in the emerging era of biology, the basic model is the organism. The behavioristic concept of the person, of course, is a mechanical model. The person will remain at rest or move in a straight line unless acted upon by some external force. It is no surprise that the transportation theory was designed to consider communication among mechanisms. Claude Shannon and Warren Weaver were engineers who had no intention of applying their theory to human communication. The humanistic concept of the person is an organismic model. The basic characteristic of an organism, as opposed to a mechanism, is that it is intrinsically motivated.

Thus humanism considers not just input information, as does behaviorism, but stored and input information. The stored information is not just previous input information. Much stored information is acquired as part of the conception-day gift. The unfolding of your human potential is guided by this stored information and input information is evaluated in

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[4] The first colloquium I attended in graduate school was presented by Howard Liddell. He described research in which he was testing the intelligence of sheep using a covered maze. He admitted sheepishly that he had crawled in to clean it one day and had taken as long to get out as his stupidest sheep. He brightened up when he reported that the second time he got lost, he did much better. When the decision to turn right or left in a maze is purely arbitrary, our much-vaunted intelligence is of no help. There is no reason why Dr. Liddell should do better than his sheep. All our intelligence provides is the capacity to benefit from experience. Thus the experimenter did better than the subject only the second time he got lost in the maze.

terms of this stored information. As will be argued later in Section 5.3, life has a happy beginning. You were born wise. You received, at the moment of conception, all the wisdom our species has accumulated over thousands of years of survival in a harsh arena. Input information is transformed in the light of this stored information.

CHAPTER 4
INTERACTIONISM AND TRANSACTION THEORY

-- so much more language sophistication comes out of a child than goes in, that you have to conclude that they were born with blueprints, plans, software - whatever you want to call it - that enables them to learn as fast as they do.

Jay Ingram
Talk, Talk, Talk, Pages 185-186

Interactionism could be viewed as a synthesis of the behavioristic thesis, as presented in Chapter 2, and the humanistic antithesis, as presented in Chapter 3. The behavioristic concept of the person was presented as a system of five propositions, and the humanistic concept of the person was presented as a system of five propositions, which contradicted the corresponding propositions of behaviorism. Let us look, in turn, at each pair of opposing propositions to suggest how the interactionist concept of the person resolves those dichotomies.

BEHAVIORISM	HUMANISM
Person only has extrinsic needs	Person has intrinsic needs
Person is conditioned from the outside in	Person is growing from inside out
Person is not responsible for behavior	Person is responsible for behavior
Person has only extrinsic worth	Person has intrinsic worth
Person has contractual relationships	Person has intimate relationships

FIGURE 4-1 BEHAVIORISM VS HUMANISM

4.1 INTRINSIC AND EXTRINSIC NEEDS

The basic proposition of behaviorism is *The person has only extrinsic needs*, whereas the basic proposition of humanism is *The person*

has intrinsic needs. This distinction between extrinsic and intrinsic needs is thus the basic difference between the behavioristic thesis and the humanistic antithesis. It is also the basic difference between a mechanism and an organism. Behaviorists, aspiring to be rigorous scientists like physicists, considered the person as a mechanism. A mechanism will remain at rest unless acted on by some external force. Thus the person is seen as being pushed and pulled by rewards and punishments. Interactionists agreed with humanists that the organism is intrinsically motivated. The person moves from the inside. Any mother of a 4-year-old child will tell you that the child will explore and manipulate the world without rewards and despite punishments.[1]

E. L. Deci reviews a number of experiments demonstrating that extrinsic motivation destroys intrinsic motivation [DECI]. For example, children lose interest in certain toys when rewarded for playing with them. One explanation for needs beyond mere survival, presented in the previous chapter, is that the needs for stimulation and consistency were originally designed by nature for survival but became functionally autonomous. They were means to an end which became ends in themselves. We fished to survive but, as pressure for survival eased up, we fished to fish. Traditional schooling reverses this process. Knowing and understanding the world is an end in itself, but schools turn it into a means to the end of earning prizes. Many parents, confronted with a listless High School child, ask what happened to that keen child who went eagerly off to kindergarten. The answer: The child went to school.

The traditional educational system, based on the behavioristic concept of the person, does not take into account the intrinsic needs for stimulation and consistency which are the organic bases for knowing and understanding. If students have their own "motors" inside, there seems little point in pushing and pulling them around from the outside. It would appear superficially that this outside "help" could do no harm and might even save some wear and tear on the engine. However, there is considerable evidence that extrinsic motivation does not add to the pre-existing intrinsic motivation but destroys it. The student, unlike the car (being an organism rather than a mechanism), tends to switch off the motor.

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[1] Anyone who has squeezed what they thought was a blackhead out of their pubic hairs and seen it scurry away knows that an organism is intrinsically motivated. My apologies for such a rude example. However, you will always remember this. The sacrifices I make for pedagogy!

4.2 GROWING AND CONDITIONING

Interactionists agree with the humanists that *The person is growing from the inside out* and with the behaviorists that *The person is conditioned from the outside in*. However, just as they emphasize intrinsic motivation, so they also emphasize inside-out growing. This is the primary process. However, the person can not grow in a vacuum.

In Chapter 2, we learned how behaviorists explained language learning as conditioning. Watson explained it as classical conditioning. Speaking is a series of conditioned reflexes in which the stimulus fedback from one response is linked to the next response. However, there is simply not enough time for the feedback from a spoken sound to trigger the next sound in the series. We speak too fast to allow the nerve impulse to make the round trip from mouth to brain and back. Nor is there enough time in our short lives to learn all the strings of sounds we use. It has been estimated that learning every possible string of words up to 20, even with perfect retention after only one presentation, would take 100 years, with no time off for eating and sleeping. It would be like learning the number system by memorizing ever possible sequence of digits.

Skinner explained language learning as instrumental conditioning. Children learn by imitating adults. However (as all parents know) children often say novel things, which they have never heard adults say. The creativity of children is nicely demonstrated by what we, in our adultocentric way, call mistakes. Children do not learn to say "goed" and "foots" by imitating adults. Such novel and "wrong" responses suggest that the learning of language can not be purely a matter of imitating adults and being reinforced for correct responses. It is more a matter of learning rules. Since the rule for past tense is “add ‘ed’, she says “goed”. Since the rule for plural is “add ‘s’”, she says “foots”. She is not at first aware that adults have those weird exceptions to the rules, but soon learns those exceptions to the rules and says “went” and “feet”.

Karena, an Inuit girl adopted by my former neighbors in the Gatineau, speaks English. Skinner could explain why she speaks English rather than Inuktatuk. She is growing up in a community in which she can imitate English sounds and sentences and is reinforced for creating English

sounds and sentences. Such a language community is a necessary condition for the acquisition of a language, but is not a sufficient condition. The same neighbors also "adopted" a husky. Pattak spent his first few years in an Inuktatuk-language community and his later years in an English-language community, but Pattak (who could be bilingual now, were he a Skinnerian dog) has learned neither Inuktatuk nor English. Karena - but, not poor Pattak - was born with the potential to speak a language, any language, and that potential could be realized by spending her early years in any language community.

After demolishing Skinner's theory [CHOMSKY 1959], Noam Chomsky, a linguist at Massachusetts Institute of Technology, proposed as an alternative his innate capacity theory [CHOMSKY 1966]. Karena could learn English because she belongs to a species which has a **language acquisition device (LAD)** built into its nervous system, whereas Pattak could learn neither Inuktatuk nor English because he belongs to a species which, alas, lacks a LAD. Karena was prewired to learn a language - not Inuktatuk or English or any particular language but whatever language was used in her environment.[2] Language is, therefore, primarily an inside-out process based on the unfolding of the genetic potential. The outside-in influence of the linguistic environment serves the necessary, but secondary, function of providing "fuel" to keep the language-generating genetic machinery working.[3] Jerome Bruner calls this the **language acquisition support system (LASS)** [BRUNER]. Every LAD needs a LASS.

Karena was not imitating adults and being reinforced for her correct responses; she was learning the rules for combining units in a language. The sentence must contain a noun phrase and a verb phrase. The noun phrase must contain an article and a noun. The verb phrase must contain a verb and a noun phrase. By applying those vocabulary rules, the **kernel sentence** is churned out. Rules of transformation may, then, be

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[2] This explains why a child can learn a language so easily. Indeed, a child can learn more than one language easily. However, to raise children to be fluently bilingual , it is better to have the two languages learned in different contexts. When we mentioned this to Pierre Trudeau on one of his visits to our think tank GAMMA, he said "*Good, the boys speak English when with their mother and French when they are with me*". It also explains why adults have difficulty learning a second language - the critical period for learning language has passed.

[3] We all, of course, know this. We all get the joke about the couple, planning to adopt a Chinese baby, who took courses in Chinese so that they would understand what she was saying when she grew up.

used to make this sentence ("*the boy hit the ball*") passive ("*the ball was hit by the boy*"), negative ("*the boy did not hit the ball*"), or interrogative ("*did the boy hit the ball?*"). Thus, underlying the sequential presentation of language (**surface structure**), there is a hierarchical structure of thought (**deep structure**). Language is an expression of thought.

Watch your professor lecture. Whatever you may think about the content of the lecture, you must admire the form. You are observing the most magnificent feat of the most exciting species on the planet. Sentences are generated, not sequentially from left to right, as common sense and behaviorism suggests, but hierarchically from deep to surface structure. You may marvel at a three-hour lecture, since you are aware of the surface structure of language, a sequence of thousands of words. However, the professor is working from the deep structure of thought, a few dichotomies. For example, I talked about classical conditioning and then instrumental conditioning. Under each, I talked about the pioneer and then a modern exponent, under each, I talked about the man and then his work. If I am so dumb that I can't even remember the few dichotomies, I flash an outline on the screen ostensibly to show you where you are at, where we have been, and where we are going but actually to remind myself.[4]

Konrad Lorenz demonstrated that nature leaves a gap in the development of the goose to be filled in by the environment by arranging that the first large moving object the gosling saw on emerging from the egg was not mother goose but Lorenz [LORENZ]. Those goslings followed Lorenz rather than mother goose, the source of satisfiers of survival needs, as nature intended.[5] Language acquisition could be considered as such **imprinting** on a larger scale. Nature leaves a large gap in the development of the human to be filled in by the language community.

Those who view teaching as an outside-in process consider it as **guided growth**. Growth is too important to be left entirely to the grower - it should be guided from the outside in. We have always known that motor development involves a series of stages, each of which is a prerequisite to the next. We must sit before we stand, stand before we walk, walk before

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[4] PowerPoint presentations have become powerful teaching aids, serving as electronic cue cards.

[5] By meddling with nature's plans, Lorenz turned behavior which served an essential survival function into behavior which served no useful function - beyond supplying cute photos for introductory psychology textbooks.

we run, and run before we play soccer. Now that we know that cognitive growth also involves such a set of prerequisite stages, we must determine the sequence of stages and guide children through them.

Extreme outside-inners have argued that, not only is the mind a "tabula rasa" (blank slate) at birth, but the "tabula" will remain "rasa" unless they write on it. Completely denying that the child is growing from the inside out, they attempt to "grow" the child entirely from the outside in. To be efficient, they "grow" the child as fast as possible.

Let us look at one such **"force-fed" child**. Boris Sidis, a professor of abnormal psychology at Harvard University, was one such extreme outside-inner. He believed that geniuses were not born but created by scientific teaching techniques, and proceeded to demonstrate his theory with his son called William James in anticipation of emulating that other genius [ROSENBERG].

William James Sidis had alphabet blocks suspended over his crib before he was 6 months old, was banging away on a typewriter at 2, learning Latin and Greek at 6, and banging at Harvard's door at 9. He was admitted at 11, lectured to the science faculty on four-dimensional bodies during his first year, and graduated magna cum laude.

So far so good. But then something snapped. He abruptly withdrew from academic work and took the lowliest job he could find. Though he feigned stupidity with genius, he sometimes slipped up by letting his genius show through, and had to refuse promotions or shift to another job. Most of his "genius" during his adult life was devoted to amassing and classifying a huge collection of streetcar transfers, to which he became fanatically attached as a symbol of his freedom during the streetcar rides between his home and Harvard University. This force-fed child grew into a tragic, lonely, obese man wandering around Boston with a spiked stick to rescue discarded streetcar transfers from the gutters.

Jean-Jacques Rousseau, in *Emile* , his influential book on education, presented an extreme inside-out view of child-rearing, from which inside-outers developed the concept of **natural readiness** [ROUSSEAU]. Do not provide instruction until the children are ready for it. The best judges of their own readiness are the children themselves. Let them learn in their own way at their own time and at their own pace. Extreme inside-outers (including one of my more naive former selves) argue that adults should

not "interfere" at all in the maturational process. We should merely sit back and gaze, with awe, at the wondrous unfolding of the human potential.

No one is sufficiently committed to this extreme view to test it by letting a child grow totally untrammeled by interference. Jean-Jacques Rousseau, consistent with his theory, came close by abandoning his many illegitimate children. However, they were raised by their mothers or in foundling homes if given up for adoption. The experiment has been conducted, however, by accident. A number of children, abandoned at an early age, have survived usually with the help of animals. Let us consider, by way of example, one such **feral child** [ITARD].

Victor was about 12 years old when he was spotted, completely naked, in the Caune Woods in France and captured as he climbed a tree trying to escape. When news of the capture of the Wild Boy of Aveyron reached Paris, fashionable society was set a-twitter with speculation about the "noble savage", a concept which Rousseau had introduced in his book.

Victor turned out to be more "savage" than "noble". He grunted like an animal, grubbed for roots and acorns to eat, and bit and scratched those who opposed him. Other romantics, who expected at least a fine physical specimen (like, say, Tarzan), were equally disappointed. Victor was filthy, scarred, stunted and moved by trotting on all fours rather than swinging from tree to tree. All such feral children behave more like the animals that reared them than the humans that bore them. Dr. Itard, who undertook the belated socialization of Victor, was never able to teach him to speak and could teach him to read only a few simple words and phrases, despite intensive efforts over five years.

No one would like their child to grow up like either William James Sidis, the force-fed child, or Victor, the feral child, and no serious theorist would argue for the extreme positions which produced them. Every theorist advocates some position along a dimension ranging between total emphasis on outside-in learning and total emphasis on inside-out maturation. Advocates of "guided growth" tend toward the outside-in end and advocates of "natural readiness" tend toward the inside-out end of the dimension. Everyone agrees that mental growth requires nourishment but that children should neither be force-fed (extreme outside-in view) nor required to forage for all their own food (extreme inside-out view). The debate is whether to present the intellectual fare as a set menu or as a smorgasbord.

Advocates of guided growth prefer the set menu. Find a healthy and balanced diet for the typical child at a given grade level, and provide this set menu as the curriculum for that grade. Each "dish" is a prerequisite to the next. If you don't eat your potatoes, you can't get dessert. Advocates of natural readiness prefer the smorgasbord. Lay out a rich variety of resources and allow the children to choose however much of whichever dishes in whatever order they desire. All you can eat for $4.50. If you have a big intellectual appetite, then you get your money's worth.

The interactionists view the student as dealing not only with input information, as in the transportation theory of communication, or not only with input and stored information, as in the transformation theory of communication, but with input and stored and fedback information. He/she is actively exploring and manipulating the environment in order to know and understand it. The exploration is guided by fedback information from the environment as a result of his/her actions. Their position could be viewed as a balance between the extreme outside-in position, with its over-emphasis on input information, and the extreme inside-out position with its over-emphasis on stored information. The relationship between input information and stored information is orchestrated by fedback information. Behavior is viewed, then, not as a series of responses to stimuli (reflex arc) but rather as a series of operations to remove a discrepancy between the present state and a desired state (feedback loop). The reflex arc is dead. Long live the feedback loop!

4.3 FREE-WILL AND DETERMINISM

The third propositions of behaviorism (*The person is not responsible for behavior*) and humanism (*The person is responsible for behavior*) directly contradict one another. We see here the philosophical debate between determinism and free-will. Interactionists resolve this conflict by pointing out that they are both right. People who have a behavioristic self-concept believe that their behavior is determined and the **self-fulfilling prophecy** (what you expect is what you get) ensures that their behavior is indeed determined. People who have a humanistic self-concept believe that they have free-will and the self-fulfilling prophecy, in this case, tends to ensure that they do indeed have free-will. In this way, the determinist and the free-willist have both accumulated "evidence" for their respective

theories. Each theory is based on what feels good rather than on what seems true.[6] You do not believe it because it is true but, rather, it becomes true because you believe it. Another example of cognitive dissonance.

Psychologists have difficulty dealing with free will. If they conduct a scientific experiment - that is manipulate an independent variable, measure a dependent variable, control all extraneous variables, and demonstrate that there is a significant difference in the dependent variable as a result of their manipulation of the independent variable, then they have established a cause-effect relationship. This is the basic building block of science. However, if the subject does whatever s/he damn well chooses, despite their efforts, the psychologist can not claim to be doing rigorous science. in the strict sense of the natural sciences.

Time after pompous time, in introductory textbooks in psychology, including my own, one reads "*this behavior is determined by some complex interaction between genetic and environmental factors*". Consider, however, the case of Chang and Eng. They were Siamese twins. Chang was a womanizer and an alcoholic, whereas Eng was practically celibate and a teetotaler. Their very different personalities could not be the result of genetic factors or environmental factors (they were genetically identical and their environments were as close as any two people ever had) or any "*complex interaction between genetic and environmental factors*".

We must consider a third factor - choice. Chang chose the short, happy life whereas Eng chose the long, miserable life. Poor old Eng had to die when Chang died as a result of his excesses. However, most of us are not attached to someone else and can make choices that help determine our lives. Most of us can organize a psychic coup d'etat to overthrow the tyranny of our genetics and our environments. We can write our own scripts. As we will see, growth from animal to human (Chapter 5) and from child to adult (Chapter 6) could best be summarized as the gradual emancipation of the person from the tyranny of his/her genes and environment.

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6 This was first pointed out to me by a wise old man I once met in Los Angeles. He had just emerged from a mental hospital, he was physically sick, his wife had left him, and his children were estranged from him. After a five-hour conversation, during which we disagreed on most topics which arose, I suddenly saw an underlying pattern. *I see now, old man, why we disagree. We have been discussing each topic at such depth that we get down to our basic philosophical assumptions. I am a free-willist whereas you are a determinist. Of course, young man you are a free-willist - your life is going well and you want to take the credit, whereas I am a determinist - my life is going badly and I don't want to take the blame.*

If the person grows from the inside out, then the person is responsible for behavior. Whereas extrinsic motivation requires extrinsic control, intrinsic motivation permits intrinsic control. The constraints of society on a person with extrinsic motivation can be replaced by the restraints of a person with intrinsic control. One symptom of a shift from the behavioristic concept of the person based on extrinsic motivation to the humanistic concept of the person based on intrinsic motivation is a shift from an emphasis on extrinsic control to an emphasis on intrinsic control. Self-control, a once-taboo topic, has become a popular area of research [GOLDFRIED & MERBAUM, MAHONEY & THORESEN].

Some critics have been appropriately apprehensive about the psychologist because of the threat that, the better psychologists understands them, the easier they can control them. This public image of the psychologist is somewhat justified, since our emphasis has indeed been on how to make organisms - whether rats or raccoons, pigeons or people behave as we want them to behave.

The shift from other-control to self-control is an encouraging sign that psychology may be turning from yet another potential instrument of oppression to one of liberation. We are beginning to present the powerful instruments we have developed to the public so that people may use them for self-understanding and self-control. Power to the person. This does not mean that we have to go back to scratch. Each technique developed for the understanding and control of others can be used for self-understanding and self-control. Behavioristic means can be used for humanistic ends.

4.4 INTRINSIC AND EXTRINSIC WORTH

If the person is responsible for behavior, then the person has intrinsic worth. The person must accept blame for bad behavior but, on the other hand, can accept credit for good behavior. That is, a person can have intrinsic worth. People who consider themselves to have intrinsic worth are said to have **self-esteem** (that is, worth in their own eyes); people who

consider themselves to have no intrinsic worth tend to seek **prestige** (that is, worth in the eyes of other people).

The prevailing behavioristic concept of the person may, thus, help explain why modern industrial societies are characterized by compulsive and conspicuous consumption. The major method of gaining prestige is to acquire possessions. The fact that prestige is not an adequate substitute for self-esteem makes it more, rather than less, potent. The person accumulates more and more possessions in a futile search for satisfaction. Other people tend to be more offended than impressed by your possessions because they too are seeking prestige. The bigger your pile, the less impressive their pile. Your greed clashes with their envy. Since a major function of a possession is to impress other people, as many of them as possible must know that you possess it. Thus, consumption becomes conspicuous as well as compulsive. The concept of conspicuous consumption was a central thesis of Thorstein Veblen [VEBLEN], who had such a profound influence on Harold Innis.

What determines which people have self-esteem and which people must embark on a compensating search for prestige? Stanley Coopersmith has studied the antecedents of self-esteem by exploring the child-rearing practices which determine the level of self-esteem of children before they go to school [COOPERSMITH]. He concluded that parents of children with high self-esteem:

- accept children in their own right,
- lay down clear and enforceable rules of conduct, and
- allow the children a wide latitude to explore within those boundaries.

Firm and fair rules provide a secure and consistent world and freedom to explore and manipulate provides the means of knowing and understanding this world.

By applying those principles, teachers can contribute to high self-esteem in their students. Two psychologists argue, however, that schools often lower the self-esteem of students [COVINGTON & BEARY]. Schools tend to link self-esteem to intellectual ability which is, in turn, linked to scholastic performance. The competitive atmosphere of the typical classroom requires that there be few successes and many failures. Students become apprehensive about their scholastic performance because it reflects back on their intellectual ability which reflects back, in turn, on their self-esteem. Many students become oriented to avoiding failure rather than achieving success. Their various strategies for avoiding failure - passive indifference, underachieving, over-striving, and so on are

self-defeating for the students (they fail because they fear failure) and frustrating for the teacher.

The authors make a number of recommendations:

- Shift from a competitive to a cooperative classroom atmosphere, in which success is not scarce.
- Shift from a situation in which students compete with one another to one in which they each compete with themself.
- Set realistic standards for each student and allow them plenty of latitude to meet those standards in their own way and at their own pace.
- Permit "freedom to fail" or, better, freedom to have temporary non-successes on their way to success.
- Shift from praise (which focuses on the standards of the teacher) to encouragement (which focuses on the standards of the student).

The words *good* and *bad* tend to scare scientists into scurrying off in search of philosophers. There seems to be no place for values in a world of facts. Some scientists are however evolving a set of values based on natural laws rather than cultural rules - that is, the propositions we have derived to describe our planet and our selves rather than the propositions we have derived to prescribe our conduct on this planet. Here is a summary of those values, as expounded by such diverse thinkers are Teilhard de Chardin, Buckminster Fuller and Kenneth Boulder.

Whereas the industrial society had to deal with an energy crisis, the information society has to deal with an entropy crisis. Entropy - the spontaneous tendency of systems towards disorder - is increasing. Biological systems, within their limited space and for a limited time, defy the law of entropy. During their growth, they become more rather than less structured. Our species, the most complex biological system, is the greatest anti-entropic force in the universe. Each of us is a defiant little package of anti-entropy fighting our brave battle against the forces of chaos.

Consciousness emerges as a function of complexity and provides the ultimate weapon against entropy. It enables us to assimilate and accommodate to information to create a microcosm of the universe within ourselves. The fuller and more accurate this subjective map of the objective world, the better we fight the good fight. It is ultimately futile, of course, we can win battles but must lose the war. Eventually, we die and get recycled as the air our survivors breathe and the water they drink. However, it is not futile for the species. Each of us spawns other defiant

little packages of anti-entropy in our books and movies and children and students, which continue the war.

We have intrinsic worth, then, because we are important elements in the complex system of the universe. We are a part of nature rather than apart from it. Our criterion of success is not wealth but health. We are healthy insofar as we realize our function in the universe - to move up the hierarchy of needs, to satisfy our biological, sociological, and psychological needs, to know and understand our selves and our planet, to build a full and accurate subjective map of the objective world.

4.5 INTIMATE AND CONTRACTUAL RELATIONSHIPS

If the person has intrinsic worth, then the person has **intimate relationships**. Since each person is unique because of their intrinsic worth, no person can be interchanged with any other within any social system, including that small society of two, involved in an interpersonal relationship, and that little society of a few in a family. All relationships are potentially intimate, since we recognize all other people as members of the same species on the same planet in essentially the same predicament. A stranger is just a friend you haven't met yet.

On the other hand, if a person has only extrinsic worth, then people are interchangeable elements within a social system. There can only be **contractual relationships** between people. Let us say you stop at a grocery store to get ingredients to cook dinner for your mate. Your relationship with your grocer is contractual. It does not really matter to you that this particular person sells you food and to him that this particular customer buys it. You take this food home and cook it for your mate. Your relationship to your mate would appear to be qualitatively different from your relationship to your grocer. Neither of you are interchangeable. It is important to you that you cook the food for this particular person and to him/her that it is you who is doing so.

However, the behavioristic concept of the person implies that this relationship is also contractual. You simply present a longer and more

complex shopping list and your mate retaliates with an equivalent list. I'll scratch your back if you'll scratch mine. This cynical view of human relationships is not some 1984ish vision of a dehumanized world but a necessary deduction from the behavioristic concept of the person. As we saw before, in Section 2.3, B. F. Skinner explicitly states this view in his book *Verbal Behavior* [SKINNER 1957]. There are two ways you can get things done - you can do it yourself (non-verbal behavior) or you can ask someone else to do it for you (verbal behavior). Verbal behavior is defined as behavior which gets things done through the mediation of other people. Other people are means to your ends.

The humanistic concept of the person implies that relationships are intrinsically intimate rather than basically contractual [MADDI & COSTI]. Instead of viewing your relationship to your mate as an extended contractual relationship, it views your relationship to your grocer as an unrealized intimate relationship. The latter is based not so much on an implicit contract to exchange food and money but on a tacit understanding not to realize the full potential intimacy. You each respect that fact that the other can handle only so much intimacy - even if only because the other has only so much time.

The shift from a behavioristic to a humanistic concept of the person is reflected in studies on **pro-social behavior** - that is, on caring, sharing, helping, understanding and other such positive behaviors which underlie intimate relationships. The cumbersome name is designed to contrast it with anti-social behavior, which has been the major focus of behaviorists, not only because it is more relevant to their concept of the person but because it is more urgent and more dramatic.

Paul Mussen and Nancy Eisenberg-Berg have summarized the research so far on the development of such pro-social behavior in children [MUSSEN & EISENBERG-BERG]. They conclude that pro-social behavior in children is increased by adults who

- engage in pro-social behavior themselves (though not by adults who only demand pro-social behavior - do-as-I-say-not-as-I-do does not work),
- reason with them as a means of discipline,
- encourage them to reflect on the feelings and expectations of themselves and of others,
- assign them early responsibilities for others (like teaching younger children),
- make explicit demands that they act maturely,

- provide them with role-playing and empathy-promoting exercises,
- reward them for pro-social behavior.

Whereas the contractual relationship is based on the rules of human beings, the intimate relationship is based on the laws of nature. We recognize other people as members of the same species on the same planet in essentially the same predicament as ourselves. If God is dead, then there is no one here but us. Other people are the only personal element in an impersonal universe. They hold out the only hope of empathy, of understanding, of caring.[7]

4.6 TRANSACTION THEORY OF COMMUNICATION

The transportation theory of communication, based on the behavioristic concept of the person, considers only input information. The person is passive, and thus simply receives the input information. The transformation theory of communication, based on the humanistic concept of the person, considers input and stored information. The person is active and evaluates input information in the light of stored information. The **transaction theory of communication**, based on the interactionist concept of the person, considers input and stored and fedback information. The person is interactive and uses fedback information to compare input and stored information.

Three brilliant young men - George Miller, Eugene Galanter, and Karl Pribram - once spent a year together at the Institute for Advanced Study in the Behavioral Sciences with nothing to do but read and write

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[7] Those two basic attitudes towards other people are nicely represented by two gestures I encountered while traveling in Nepal. The traditional gesture is to hold your hands as in prayer, bow, and say *"namaste"* which means *"I honor the divinity in you"* . The other gesture - alas, in urban areas where Western values have pervaded - is to hold out one hand palm up and say *"rupee"*. The shift from *"namaste"* to *"rupee"* is symptomatic of a shift from intimate to contractual relationships.

and talk and think. Under those ideal circumstances, something was bound to happen. Indeed, it did. They wrote a book, *Plans and the Structure of Behavior*, which shook psychology at its foundations [MILLER ET AL].

Their argument went as follows. Our behavior is determined by what is happening around us. The optimists within psychology (behaviorists) try to explain what comes out entirely in terms of what goes in (input information). We are empty boxes. The pessimists within psychology (humanists) try to explain what comes out in terms of what comes in plus what was already there (input and stored information). We are no longer empty boxes - there is a box containing stored information within the box. The pessimists are not pessimistic enough. There is no mechanism for getting the box into motion.

They turned for inspiration to the computer. The computer has input and output corresponding to environment and behavior, and memory corresponding to stored information. However, it also has a set of instructions, called a program, stating what to do with this input and stored information. Substituting image for memory and plan for program, we now have a model for the person, which involves input, stored, and fedback information. They called it the **TOTE unit**, because one tested the input information from the environment against the stored information of a desired future state (Test), operated according to a plan to reduce the discrepancy between input and stored information (Operate), test again (Test), and so on around this feedback loop until input and stored information correspond, and then exit from the plan (Exit) (see Figure 4-2).

Consider, for example, the simple operation of hammering in a nail. TEST The head of the nail is not flush with the surface of the wood (the desired state). OPERATE Hit the nail with a hammer. TEST Still not flush. OPERATE Hit it again. Test and operate repeated until the head of the nail is flush with the surface of the wood, then EXIT. That plan is completed. This simple plan is a sub-plan of building a door, which is a sub-plan of building a room, which is a sub-plan of building a house.

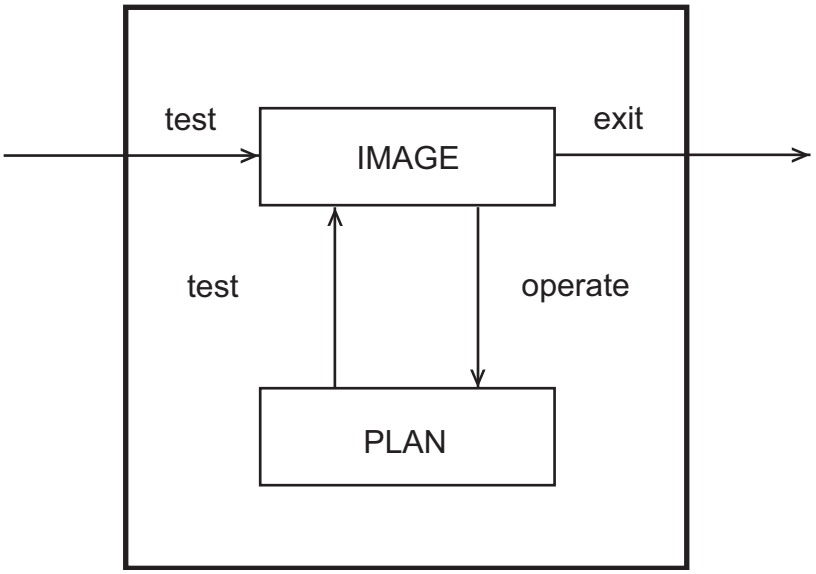

FIGURE 4-2 THE TOTE UNIT

Miller, Galanter, and Pribram proceeded to explain more complex behavior using this model - for example, behavior under hypnosis. Psychologists tended to lose interest in hypnosis when Sigmund Freud abandoned it in favor of his famous free-association technique. They argued that, since hypnosis had acquired a bad name through association with stage magicians and international spies, it is much too controversial to be touched by conventional and respected scientists. However, hypnosis has many dramatic effects on behavior, it stands as a challenge to those who aspire to explain behavior. It stands perhaps as too much of a challenge. It may be that psychologists have neglected it for the same reason that they have neglected human dignity and moral courage and tenderness and poignancy: it is a complex phenomenon and psychology is, as yet, a simple science.

The new model of the person described above presents a glimmer of a hope of a satisfactory explanation of this complex phenomenon.[8]

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[8] I once presented this argument to the Canadian Association of Hypnotists. Talking to a hundred hypnotists is a strange experience. However, I was able to describe behavior under hypnosis to their satisfaction using this theory. The President later took me back-stage to meet The Great Reveen, an Australian hypnotist who entertained audiences around the world and he gave the theory his seal of approval.

Miller, Galanter, and Pribram argue that our plans are orchestrated by our inner voice which gives instructions to ourselves. Children do this out loud but, told by adults that big boys and girls don't talk to themselves, they continue to do it in a voice so low that no one else can hear. They suggest that people in a hypnotic trance have relinquished control of their plans to the voice of the hypnotist. Many well-documented facts about hypnosis can be explained, without undue strain, within this theoretical framework. The fact that it is difficult to hypnotize subjects against their will means that they refuse to relinquish their planning function. The fact that subjects tend not to do things that they would not normally do means that the impression that the hypnotist's voice is their own inner voice must be maintained. The fact that the hypnotist often uses sleep suggestion means that s/he is capitalizing on the subjects' lifetime of experience in suspending the planning function as they go to sleep. When subjects suspend their own planning function, they are susceptible to the insistent plans of the hypnotist, since planlessness is death.

Few conversations, however, are between a hypnotist and a subject in which the hypnotist takes over the planning function of the subject. Most conversations are between two people each of whom has their own plans, which they are pursuing as they deal with input, stored and fedback information. In our conversation, my output is your input or your feedback if I am responding to you, and your output is my input or feedback if you are responding to me. Our plans may be synergetic if we are, for example, seeking to entertain or enlighten one another, or they may be antagonistic, if I am trying to sell you something you don't want to buy or you are trying to convince me of something I do not believe. In a good conversation, we are both free to express ourselves fully and we both receive honest feedback.

Social sciences, including communication studies, are usually based on the behavioristic concept of the person and thus the corresponding transportation theory of communication. The **Standard Social Science Model** (SSSM) is based on the assumption that the mind is a **tabula rasa** and that this "tabula" will remain "rasa" unless it is written on. My argument here is that the humanistic concept of the person and its corresponding transformation theory of communication is a better model, and that the interactionist concept of the person and its corresponding interaction theory of communication is an even better model.

The theory based on those better concepts of the person will be more accurate. That is, the concept of communication in which you and I

are having a conversation in which each of us is dealing with input, stored, and fedback information to complete our plans is better than the concept of information being transported from me to you. The better concepts of the person also lead to better practice. Time-Warner merged with AOL on the assumption that Time-Warner could deliver its vast library of magazines and books (Time) and movies (Warner) to the captive, passive audience of subscribers (AOL). They lost billions of dollars. Google bought YouTube for 1.35 billion dollars. YouTube had no magazines and books and movies. All they had was a space where people were invited to bring their own movies and to view the movies of other people. YouTube invited people to be active (humanism) and interactive (interactionism). The Google-YouTube merger will earn billions of dollars. The difference between losing and earning billions of dollars is the difference between a poor and a good concept of the person.

The moves from behaviorism (1920s) to humanism (1960s) to interactionism (1980s) could be considered as paradigm shifts within the science of psychology. Psychologists have indeed, as behaviorists hoped, emulated physicists. They have gone through paradigm shifts just as the physicists went through shifts from the paradigm of Ptolemy to that of Copernicus to that of Newton to that of Einstein to that of some unsung genius yet to come.

Alas, those shifts take us beyond the simple empty-box of the behaviorist, with stimuli going in and responses coming out. The environment must be analyzed into ecosphere, sociosphere, and technosphere, each of which has a different logical relationship to the person rather than simple stimuli: behavior must be considered as governed by plans which reduce the discrepancy between input information and a desired state stored in the image rather than as simple responses (see Figure 4-3).

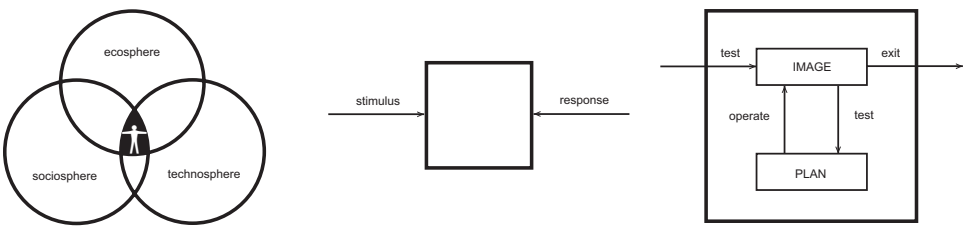

FIGURE 4-3 FROM SIMPLE TO COMPLEX CONCEPT OF PERSON

CHAPTER 5
FROM ANIMAL TO HUMAN (DARWIN)

5.1 THEORY OF EVOLUTION - CHARLES DARWIN

5.2 NON-VERBAL COMMUNICATION - PAUL EKMAN

5.3 LANGUAGE ORIGIN AND STRUCTURE - ROBIN DUNBAR

5.4 LANGUAGE AND HUMAN NATURE - STEVEN PINKER

5.5 SYSTEMIC UNDERSTANDING OF LIFE - FRITJOF CAPRA

5.6 CONTRIBUTION TO MEDIA STUDIES AND STUDENTS

(Our) ways of knowing and core intuitions are suitable for the lifestyle of small groups of illiterate, stateless people, who live off the land, survive by their wits, and depend on what they can carry. Our ancestors left this lifestyle for a settled existence only a few millennia ago too recently for evolution to have done much, or anything, to our brains. Conspicuous by their absence are faculties suited to the stunning new understanding of the world wrought by science and technology.

Steven Pinker
The Blank Slate: The Modern Denial of Human Nature

Behaviorists, aspiring to be seen as rigorous scientists, followed in the footsteps of physicists. They considered the person as a mechanism. In presenting humanism as an antithesis to this behavioristic thesis and interactionism as a synthesis, we have gone beyond a passive model to an active and then an interactive model, beyond dealing with only input information to dealing with stored information and then fedback information. We have presented in chapters 2, 3, and 4 progressively more and more sophisticated models of the person. However, they are still mechanistic models. The person is still considered as an information-processing system. Note that Miller, Galanter, and Pribram sought inspiration in the analogy with the computer.

The next two chapters focus on human development - from animal to human - phylogenetic development (Chapter 5) and from child to adult - ontogenetic development (Chapter 6). They shift our focus from physics to biology. Darwin's theory of phylogenetic development and Piaget's theory of ontogenetic development place the person firmly where s/he belongs within the field of biology rather than physics, as an organism rather than a mechanism.

5.1 THEORY OF EVOLUTION - CHARLES DARWIN

This chapter of our story opens in a quiet country home in an English village. Our next major character is seen puttering about in his greenhouse and muttering about in his study. It was in this place and in this manner - apart from a famous voyage around the world aboard the H.M.S. Beagle - that Charles Darwin spent most of his life. Yet this uneventful life of this unassuming man in this unspectacular setting had a greater impact on our world than did the lives of some of the more flamboyant figures - the Caesars, the Napoleons, the Hitlers - who have stomped around our globe.

Darwin created a revolution. Not that shoddy shift in political personnel that typically passes for a revolution, but a real revolution - a change in our view of ourselves. After carefully collecting and collating

evidence for 17 years, Darwin gently but firmly told us that we are not a special creation of God with an exclusive soul but an animal on the same scale as our dogs and our cows. After the inevitable violent reaction - Scopes v. State of Tennessee, Professor Huxley v. Bishop Wilberforce - we swallowed this bitter pill. Indeed, we now find it not only palatable but sweet. Most of us feel better as raised apes than as fallen angels.

Psychologists are often criticized for spending so much time working with animals. They tend to defend themselves in terms of practical advantages. You need not make appointments with animals, or establish rapport with them, or pay them for their services. You can cage animals, shock them, and interbreed them. Animals have simpler nervous systems than humans and can, therefore, be better studied by our as-yet-simple tools. Animals take less time to mature than humans and, thus it is easier to study the effect of early experience on late behavior. Experimenters tend to prefer subjects who are unlikely to outlive them.

Darwin provides a better answer. I study the behavior of rats because I am interested in the behavior of humans. Since rat and man both developed according to the same principles, as expounded in the theory of evolution, some insight into man can be gained by the study of the rat. Just as we get some insight into a single organism by tracing the development of that organism (ontogenetic approach), we can get some insight into a species by tracing the development of that species (phylogenetic approach).

Alfred Russel Wallace (1823-1913) had discovered the principle of natural selection at the same time as Darwin. Indeed, he published the same theory in the same issue of the same journal [DESMOND & MOORE, Pages 466-471]. Most people assumed, as did I, that he does not get as much credit as Darwin, because he did not spend 17 years accumulating empirical evidence for the theory. However, it is now clear that he had done his homework. The main reason he does not get as much credit is because he subsequently abandoned the theory. He could see no way in which adaptation to a hunter-gatherer society could explain the sophisticated modern mind. How could a species, which evolved by adapting to a hunter-gatherer society, deal with the dramatic shifts to an agricultural society, then to an industrial society, and now to an information society?

We are all familiar with the basic principles of the **theory of evolution**. Here, however, is a Rip Van Winkle special by way of reminder. There are individual differences from individual to individual within any

species. Because of certain environmental conditions, the individuals at one end of a particular scale have some advantage over the others. Because of this advantage, they are more likely to survive. Because they are more likely to survive, they are more likely to reproduce. Because traits are inherited, the next generation of this species will be, on the average, further along toward the desirable end of this scale. This generation, in turn, breeds another generation even further along, and so on and so on.

Let's take a concrete example. Giraffes differ in the length of their necks. The longer-necked giraffes are better able to feed off the leaves in high trees and are thus more likely to survive and reproduce. Since long-necked giraffes tend to have long-necked babies, the next generation will have, on the average, longer necks, and the next generation even longer necks, and so on. Note that no giraffe grows a longer neck during its lifetime by stretching it to reach leaves and then passes its longer neck on to its progeny. This is Lamarck's erroneous concept of the inheritance of acquired characteristics.

Whereas most of us are familiar with the initial reaction to the theory of evolution, we may not be as familiar with its subsequent history. It suffered a decline, because many malicious or simply silly people misused the theory as a rationalization for an extreme interpretation of capitalism as a survival-of-the-fittest principle applied to the social sphere and as an argument for eugenics - the "improvement" of the species by pruning out the unfit [DEGLER].[1] Social scientists were so horrified by this interpretation of the theory of evolution that they swung to the other extreme of denying any influence of our evolutionary past on our present behavior. Their Standard Social Science Model (SSSM)**,** which underlies the social sciences, including communication studies, assumes that the mind is a "tabula rasa", a blank slate on which culture writes.

The debunking of those false arguments has resulted in a revival of the principle of **natural selection** as a basic principle for the psychological and social sciences. A spate of recent books by evolutionary psychologists [e. g. BARKOW ET AL, PINKER 2002, WILSON 1998] argue that the human mind, which has evolved over thousands of years to enable us to survive in the harsh arena of our environment, is a medium which

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[1] By the way, Charles Darwin never ever suggested such implications of his theory. The main early exponent of social Darwinism was Herbert Spencer, his cousin. We have all had the experience of being blamed for something our cousin did.

determines how the message of culture is received and interpreted. This "tabula" is far from "rasa". Much has been written on this slate over evolutionary times. We cannot deny human nature. They argue therefore that we need to ground our sociology in psychology and our psychology in turn in biology. This inevitably leads to natural selection and the "*natural selection*" of Charles Darwin, superficially an unlikely candidate, as an important contributor to the psychology of communication.

We tend to think of the theory of evolution as a biological rather than a psychological theory - as concerned with the development of structure rather than of function. Perhaps the emphasis has been on structure because, with the death of an organism, structure survives but function fades. Much evidence for evolution is therefore based on structure (skeletons) or the imprint of structure (fossils). However, the giraffe survives not only because it has a long neck but also because it can use it. The structure-function relationship is a chicken-and-egg problem. We do not know whether an egg is one chicken's way of producing another chicken or whether, as Samuel Butler suggested, a chicken is one egg's way of producing another egg. We do not know whether birds have wings because they fly or fly because they have wings. Modern evolutionary psychology is exploring the evolution of function as well as structure, of the mind as well as of the body. Let us look in turn at the work of three evolutionary psychologists - Paul Ekman, Robin Dunbar, and Steven Pinker - who have continued the work of Darwin by exploring the psychology of communication.

5.2 NON-VERBAL COMMUNICATION - PAUL EKMAN

In 1872, thirteen years after he published his most famous book, *The Origin of Species* [DARWIN 1859], Charles Darwin published a more obscure book, *The Expression of Emotions in Animals and Man* [DARWIN 1872]. This book bolstered his theory since, as his biographers say "*Any sympathetic observer could see that man and animals shared not only feelings, but the means of expressing them.*" [DESMOND & MOORE, Page 593]. One of the recent re-publications of this

book contains an Afterword by Paul Ekman summarizing the research in this domain since its first publication.

Ekman concludes that Darwin had got the principles that govern such non-verbal communication of emotion essentially correct [EKMAN]. He himself had conducted research in many diverse cultures and discovered that the facial expressions corresponding to the basic human emotions were universal. Not only did a member of a remote tribe in New Guinea make the same expressions but could identify the emotions expressed by a Caucasian even though Paul Ekman was the first white man he had met. Since we are all members of the same species with a shared evolutionary history, we share the same emotions and express them in the same way. Since it is of evolutionary value to recognize faces, and to read the emotions they express, it is not surprising that there is an area of the brain dedicated to facial recognition, and that no one ever says "*I remember your name but I can't place your face*".

There are many practical applications of this theory, originated by Darwin and refined by Ekman. Lie detectors are not admitted in courts, but Paul Ekman is often consulted as a lie-detector to detect lies in videotaped speech. He is also consulted by actors, who simulate emotions - when asked what he does for a living, Clint Eastwood says "*I make faces*". Paul Ekman, who has mastered the control of the various muscles which create the faces corresponding to the various emotions, can teach them to make the appropriate faces. As animation gets more and more realistic, animators must learn how to simulate the various human emotions.

Darwin did not consider language. He was focussed on what animals and humans had in common. The expression of emotions in animals and humans is dramatically similar, as he brilliantly demonstrated. However, he did not go beyond non-verbal communication to verbal communication. Language is what best *distinguishes* us from the other animals. Let us look at the work of two evolutionary psychologists who help fill in this "missing link" in the theory of evolution.

5.3 LANGUAGE ORIGIN AND STRUCTURE - ROBIN DUNBAR

The traditional argument for the importance of language is that we needed to communicate to hunt large animals. In his book, *Grooming, Gossip, and the Evolution of Language*, Robin Dunbar argued that we also needed to communicate because large animals hunted us [DUNBAR]. As relatively small, slow, and puny animals, we banded together for mutual protection. Clustered in groups we had many ears and many eyes to warn us of danger. Thus trust, essential for social animals, was established within a group by mutual grooming. He argued that language evolved as a sort of grooming-at-a-distance strategy when the optimal group size got too large for direct grooming. Gossip too served an evolutionary function because it can lead to a bad reputation and thus ostracizing of members of the group who can't be trusted.

Despite such attempts by evolutionary psychologists like Dunbar, the origin of language in our species is still shrouded in mystery. It happened very long ago and it has left no physical record. The absence of evidence does not, however, prevent us from having theories about it. Indeed, it seems that the fewer the facts, the more the theories. Speech evolved as imitation of sounds heard in nature (**ding-dong theory**), as imitation of sounds made by animals (**bow-wow theory**), out of interjections (**oof-ouch theory**), to accompany strenuous group activity (**yo-he-ho theory**) are a few of the candidates. Speculation about the origin of language was so rife and viewed as so futile that, in 1866, *Société Linguistique de Paris* banned any further discussion in their journals [DEACON, Page 14].

Perhaps it is more important to find out what is unique about human language than to find out how it started. An alternative approach is to identify the design features of language and determine which features distinguish human from animal communication. Charles Hockett lists three such design features of human language - displacement, productivity, and duality of patterning [HOCKETT]. While I was a graduate student at Cornell University, a campus debate developed between Charles Hockett and Karl von Frisch, who had conducted extensive research on the "language" of bees [VON FRISCH 1950]. He had discovered that a bee could communicate the source of pollen to other bees in the hive by doing a

dance in a figure-eight, in which the angle of orientation of the 8 indicated the direction and the number of wiggles in performing the figure-eight indicated distance from the hive. That is, it passed on the polar coordinates of the pollen source. Von Frisch argued that this "language of the bees" had the design feature of displacement - the bee could "talk" about things which are not here and now - and productivity - the bee could "say" things which have never been said before, when it gives precise polar coordinates never before used by its species.

Hockett argued that such communication between bees should not be described as "language" (hence the inverted commas around language in his title). It was pre-wired into the genetic code of bees - that is, it was genetic not *extra*genetic. This argument was vindicated by later work by von Frisch himself on dialects in bees. When North American bees were mated with European bees with a different "dialect", the sons of bees could not communicate with either parent, since their "language" was some compromise between the two dialects [VON FRISCH 1967].

In my introductory psychology textbook, I included a footnote to the third distinguishing design feature of human language - duality of patterning - which stated that I didn't understand this feature [GARDINER 1970].[2] In the second edition, I added a footnote to this footnote, in which I stated that I had talked to Charles Hockett about this feature and I still didn't understand it. You'll be happy to know that I now finally understand it.

Language is a hierarchy of units plus rules for combining units at one level to create meaningful units at the next level. More precisely, language consists of phonemes (roughly equivalent to the letters of the alphabet), morphemes (roughly equivalent to the words in the dictionary), sentences, and discourses, plus the rules of vocabulary to combine phonemes into morphemes, of grammar to combine morphemes into

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[2] My editor was initially horrified. Textbook writers are supposed to know everything about their subject. However, he kindly permitted me to include the footnote, on the grounds that this textbook writer was an exception.

sentences, and of logic to combine sentences into discourses (see Figure 5-1).[3]

Thus language has semantic rules, which link it to the objective world, plus those syntactical rules, which link its elements together. This duality of functioning is unique to human communication. Humberto Maturana makes this point more concrete by describing a dialogue with his cat [MATURANA & VARELA]. Normally the cat says "meow" and he feeds it. They communicate. He has forgotten to get the cat food. "Meow" no food. "Meow" no food. With it's third "Meow", the cat can't say "I've said 'Meow' two times before and still no food". They can't communicate about communication. They both know the semantic rules but only Maturana knows the syntactic rules. In Chapter 11, we will discuss the two distinct areas of the brain responsible, respectively, for the semantic and syntactic aspects of language.

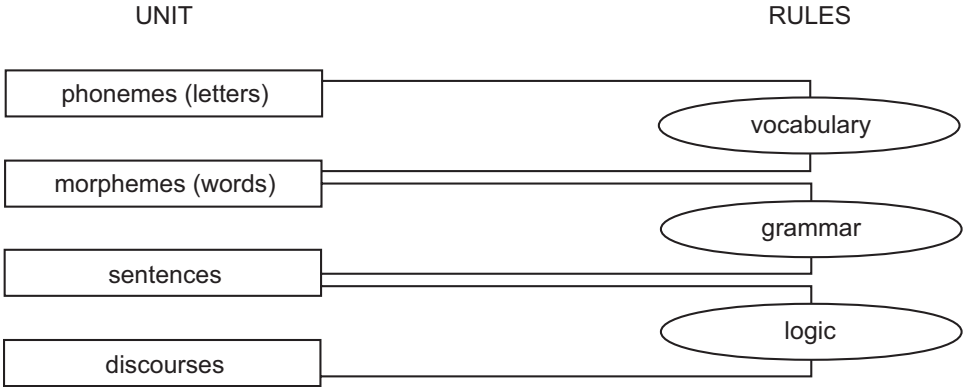

FIGURE 5-1
HIERARCHICAL STRUCTURE OF LANGUAGE

[3] I say "roughly" because there is not perfect phoneme-grapheme correspondence and there are some morphemes - the smallest linguistic unit which has meaning of its own - which are not words. For example "ed" at the end of a verb means past tense.

5.4 LANGUAGE AND HUMAN NATURE - STEVEN PINKER

Steven Pinker grew up in Montreal, graduated from McGill University, went to MIT to study with Noam Chomsky, and is now a professor at Harvard University. According to *Time Magazine*, he was one of the 100 most important people in the world in 2006. He has no doubt retained his place with the publication of *The Stuff of Thought* in 2007. The titles of five of his recent books are listed in Figure 5-2. As you can see he has been alternating between books on language and books on human nature. The fifth book - *The Stuff of Thought* - could be considered as the conclusion of a trilogy on both his language and human nature series, in which he argues, as the subtitle tells us, that *Language is a Window into Human Nature*.

THE LANGUAGE INSTINCT
(1994)

HOW THE MIND WORKS
(1997)

WORDS AND RULES:
THE INGREDIENTS
OF LANGUAGE
(1999)

THE BLANK SLATE:
THE MODERN DENIAL
OF HUMAN NATURE
(2002)

THE STUFF OF THOUGHT:
LANGUAGE AS A WINDOW INTO HUMAN NATURE
(2007)

FIGURE 5-2 FIVE BOOKS BY STEVEN PINKER

First, a word about *How The Mind Works* [PINKER 1997]. Such a title may be premature and presumptuous but it is no longer preposterous. Evolutionary psychologists, like Pinker, are transforming many mysteries of mind into mere problems. As a child, I was addicted to jigsaw puzzles. I would start with the outer edge and work inward frame by frame. According to Pinker, the outer border of the jigsaw puzzle of mind is the principle of natural selection and the next border is the concept of the nervous system as a tool for processing information to enable us to survive (see Figure 5-3).

In Chapter 10, I will present the theory of Marshall McLuhan that media may best be considered as extensions of the nervous system. This provides a third border to our jigsaw puzzle. In a previous book - *A History of Media* [GARDINER 2002] - I argue that the Big Story of historical time is the co-evolution of the person and media as extensions of the nervous system. We are born with a means of storing information (memory) and a means of transmitting information (speech). This first generation of media was adequate for a hunter-gatherer society. However

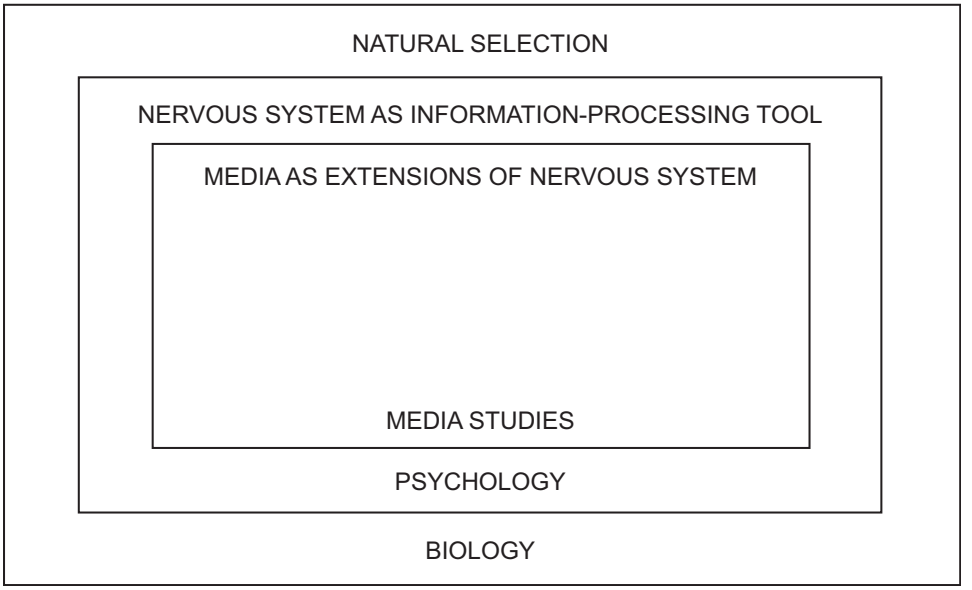

FIGURE 5-3 HOW THE MIND WORKS
(With thanks and apologies to Steven Pinker)

our inventions of an agricultural society, an industrial society, and now an information society, required correlated inventions of media to extend our nervous systems. We had to store information outside our bodies (Print and Film - second generation), transmit information outside our bodies (Telephone and Television - third generation) and both store and transmit information outside our bodies (Multimedia and Internet - fourth generation). If I may be so immodest as to place myself in the distinguished company of Darwin, Pinker, and McLuhan, this provides a fourth frame in the jig-saw puzzle presented in Figure 5-3. This is at least part of the answer to the **Wallace Paradox** described above. The transition to those more complex societies was enabled by using media to extend our nervous systems.

Second, a word about *The Blank Slate: The Modern Denial of Human Nature* [PINKER 2002]. This devastating critique of the argument that the mind can be usefully considered as a blank slate destroys the Standard Social Science Model (SSSM), which has dominated the Social Sciences till recently. This model assumes that the mind at birth is a blank slate (tabula rasa) on which culture writes. Pinker argues convincingly that your tabula was far from rasa, and documents in detail the process by which your mind is a medium shaped by the past experience of our species and it in turn shapes the content assimilated from your culture.

Third, a word about *The Stuff of Thought: Language as a Window into Human Nature* [PINKER 2007]. Having destroyed the SSSM, Pinker is obliged to provide his concept of human nature as a basis for an alternative Social Science Model. Having geared up with two previous books on language - *The Language Instinct* [PINKER 1994] and *Words and Rules: The Ingredients of Language* [PINKER 1999], he is now ready to look through the window of language into human nature. What does he see? In Section 2.1, we learned that the nervous system mediates between the internal and external environments to enable us to survive by approaching things which are good for us and avoiding things which are bad for us. However language serves as a mediator between our internal and external environments to not merely survive but to thrive. We are thus able to satisfy not only our biological needs, as argued by behaviorists, but also our sociological and psychological needs, as argued by humanists.

We are natural-born scientists. Science involves observation and reason. Every language contains the concepts of time and space, cause and effect, as the basis for observation. *"The mind isn't a blank slate, but it isn't an overstuffed filing cabinet either"* (Jonah Lehrer). It does not contain innate ideas of Hula Hoops and iPhones, but of time and space, cause and effect since those are the basic dimensions of the physical world. In Chapter 6, we will discover that every language has all the logical operators - if -then, either - or, etc. - required for logic. That is, language contains the means for reason.

Language links our outer world (objective world) and our inner world (subjective map). Since the brain is part of the objective world, it is not surprising then that it has the same basic structure as the objective world and that the mind, which emerges from the brain, produces a subjective map that is isomorphic with that objective world, and thus enables us potentially to create an accurate subjective map of it. We are not surprised that our perception enables us to perceive the world as it is.

Pinker's surprise is that our conception enables us to *conceive* the world as it is. The potential to know and understand the world, through observation and reason, is innate.

5.5 SYSTEMIC UNDERSTANDING OF LIFE - FRITJOF CAPRA

Darwin never understood the mechanism underlying the process of evolution. There was chance variation and natural selection, but how was this information passed on from generation to generation? Gregor Mendel knew the answer. Ironically, this unassuming monk had published the basic principles of genetics in an obscure journal, which was found uncut and therefore unread in Darwin's library. His article was discovered many years later and integrated into a revised theory of evolution. James Watson and Francis Crick provided an even deeper understanding of the process of evolution when they uncovered the genetic code in which we are written [WATSON JA]. It is a language of four letters arranged in a double helix.[4]

The next step was the Human Genome Project in which the sequence of letters in the human genome were laid out. This was accomplished in a surprisingly short time - partly because of vast improvements in the technology and partly because there was a race between private and public institutions. Private won but, rather than attempt to copyright and make a fortune, as many people feared, the leader of the private team made it available free to everyone on the internet [SHREEVE].

There were further surprises in the human genome itself. It turned out to be short (there are varieties of rice with more genes), and there are master genes which control other genes (those we shared with very simple, primitive organisms). This lent some support to Steven Jay Gould, Richard Lewontin, and other evolutionary psychologists who argued that there

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[4] The Franklin footnote. It is subsequently been revealed that Rosalind Franklin deserved a share in the resultant Nobel Prize. Two books go way beyond the obligatory footnote to present a strong argument for her case [MADDOX, SAYRE].

could be sudden, dramatic shifts in the evolutionary process. Such changes could be attributed to changes in those master genes which cascaded throughout the entire system under their control.

A major problem with the theory of evolution, as Darwin presented it, is that gradual change through very occasional mutations (errors) in the transmission of the genetic code could not explain the emergence of complex systems like, for example, the eye. The search for missing links, like simple versions of the eye, have been futile. This provides further evidence for sudden shifts in evolution (*evolution by jerks*) as opposed to gradual evolution (*evolution by creeps*).

In modern evolutionary theory, the problem of the emergence of complex systems shifts from the eye (structure) to language (function). There are no simple languages - that is, missing links, which would lend support to the theory of evolution as first formulated by Darwin. Fritjof Capra argues that, whereas master genes may help explain sudden shifts, the answer lies outside the genetic system [CAPRA]. What is passed on from generation to generation is not just the genetic code, but the entire organization of metabolic networks. The so-called *secret of life* is written not just in the genes but in the entire cellular network of enzymes, membranes and other cellular structures. The process is not just genetic but epigenetic. Mutations are not random but are "*actively generated and regulated by the cell's epigenetic network, and* (thus) *evolution is an integral part of the self-organization of living organisms*." [CAPRA, Page 167].

5.6 CONTRIBUTION TO MEDIA STUDIES & STUDENTS

History is mostly STORY - the HI is just to get your attention. So HI - now here's the STORY. Traditionally, history starts with our invention of writing rather than our acquisition of speech. Writing is more convenient (there are permanent records) but speaking is more meaningful. Since our pre-history has had a profound impact on our history, we should anchor history in pre-history.

Many people, to whom I described my plan to put history within a pre-historical context, recommended I read *Guns, Germs, and Steel: The Fate of Human Societies* [DIAMOND]. When I finally read the book, I realized that they were telling me gently that it had already been done! Jared Diamond answered a question posed by his New Guinea friend, Yali: "*Why is it that you white people developed so much cargo and brought it to New Guinea, but we black people had little cargo of our own?"* by going back to pre-history to explore a complex of factors including food production, domestication of large animals, germs acquired from those animals, large populations, and central organization. It has indeed been done for traditional history based on conflict. Here it is done again for an alternative history based on communication.

History is usually the story of conflict as told by the winners.[5] During a war between two groups in Egypt, the Library of Alexandria was destroyed; because of the outcome of a war in Turkey, scholars were forced to flee to Europe and thus trigger the Renaissance. Those two events are presented in traditional history as incidental by-products of the wars. In the history of communication, those events are the important events. The various wars are just footnotes about failures of communication.

Who remembers or cares that this gang of thugs captured that piece of land? The important effect on civilization was that a certain subset of the knowledge of the Greeks was preserved, which determined our view of them and the subsequent history based on their wisdom. The important issue between those two events is not which gangs gained which territories but who preserved this wisdom during the interval and how it was stored and transmitted to future generations. Cleopatra had lent many volumes of the books in the Alexandria Library to her lover, Mark Anthony, who had them copied and preserved in the Pergamon Library in Turkey.[6] Such little-recorded facts are much more important than the well-documented wars that bracketed the destruction of the library in Alexandria and the flight of scholars from Istanbul.

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[5] Mark Russell, the political satirist, covered 1000 years of history in 10 minutes during his millennium presentation. How is this possible? He leaves out the wars.

[6] The fact that those books were there was one of the reasons why the scholars were there. Fortunately for us, Mark Anthony sent back the copies, with their inevitable errors, and kept the originals.

H. G. Wells describes human history as "*a race between education and catastrophe*" [WELLS H]. Traditional history focuses on "catastrophe" with "education" as footnote; this history focuses on "education" with "catastrophe" as footnote. Well's metaphor of the race has been brilliantly rephrased in modern and empirical terms as an "ingenuity gap" between our problems and our capacity to solve them [HOMER-DIXON]. This book is my small contribution to closing that ingenuity gap.

Despite the argument that "*the pen is mightier than the sword*", history continues to tell the story of the sword. This is the story of the pen, penned in the hope that it will not be used to encourage conflict. It argues that the history of media is the Big Story of historical time. It tells how our species has dealt with the dramatic shifts from a hunter-gatherer to an agricultural to an industrial to an information society by developing extrasomatic tools to store and transmit information outside our bodies.

How far back in pre-history should we go? Who made the Big Bang? Who heard it? There is merit in going back to the beginning, but perhaps not *that* far back. That was way before our time. We appeared only during the Pleistocene Era of the **Quaternary Period** in geological time (1,800,000 to 10,000 years ago). That is, we appeared on the global stage only in the fourth act. During that era, there was a more-recent but less-familiar Big Bang - not of the universe but of the brain. There was a sudden explosion of human creativity - cave paintings, ornaments buried with the dead, musical instruments - about 35,000 years ago. There are differences of opinion about the date, about the "suddenness" of the event, and about its cause. However, for us, it is important only to note that the breakthrough involved language.

Each period in genealogical time is divided into eras (see Figure 5-4). During the Pleistocene Era, two candidates were competing to be our ancestors - Cro-Magnon and Neanderthal. The former survived and evolved into us, whereas the latter became extinct. Neanderthal was bigger, faster, and stronger than Cro-Magnon but Cro-Magnon had a vocal apparatus which could emit a wider range of sounds, and thus a more sophisticated language. The Big Bang thus occurred in the Cro-Magnon brain but not in the Neanderthal brain. Communication was an important factor right from the beginning. History focuses on the **Holocene Era** (10,000 to the present) - that is, since the beginning of the agricultural society, when the hunter-gatherer settled down. However, during this Holocene Era, our species has extended itself by piggy-backing media on to language, acquired during the **Pleistocene Era**.

PRIMARY PERIOD

SECONDARY PERIOD

TERTIARY PERIOD

QUATERNARY PERIOD
PLEISTOCENE ERA (1,800,000 - 10,000 years ago)
HOLOCENE ERA (10,000 years ago - present)

FIGURE 5-4 GEOLOGICAL TIME

There are a number of advantages to starting our story with prehistory rather than with history.

• *A happy beginning*. Traditionally, your individual biography starts with your birth rather than your conception. Just as in our collective biography (history), this choice is based on convenience. The date of birth is more convenient (it is easier to pinpoint) but the date of conception is more meaningful. That is when you received the conception-day gift of all the wisdom our species has acquired over thousands of years of survival in a harsh arena. Life does not have a happy ending. However, it has a happy beginning. You were born wise.

• *A firm foundation*. In Chapter 10, I will argue that part of that gift is a means of storing information (memory) and a means of transmitting information (speech). Memory and speech is the firm foundation on which media history rests. The first generation of media is thus Memory and Speech. The history of media can best be considered as the story of how our species has extended the nervous system by storing information outside our bodies (Print and Film - Second Generation), by transmitting information outside our bodies (Telephone and Television - Third Generation), and by both storing and transmitting information outside our bodies (Multimedia and Internet - Fourth Generation).

• *A coherent story*. What we know of the history of media tends to be a miscellaneous collection of facts and theories, anecdotes and opinions. Thus we read the anecdote about Alexander Graham Bell trying to

build a device to aid his mother and his wife, who were both deaf, and accidentally inventing the telephone, which ironically he could never use to call his mother or his wife. We hear the anecdote about 14-year-old farm boy, Philo Taylor Farnsworth, basing the path of the television image on the back-and-forth path of his ploughing. Those stories fit within the framing story of the need for a means of transmitting information quickly over large distances as we moved into an industrial society. This in turn fits within the coherent story provided by the pre-historical context.

• *A consistent theory*. Communication studies is a pre-paradigm discipline.[7] That is, there is no broad framework, widely accepted by the scholars in the discipline, within which they work. This chapter aspires to provide such a broad framework by fitting media studies into perhaps the most widely-accepted paradigm of all - the theory of evolution. There is no generally accepted theory of history. There is, however, a theory of pre-history - the theory of evolution. Our species has co-invented social and media systems to survive in our changing cultural environment - agricultural society and the second generation of Print and Film, industrial society and the third generation of Telephone and Television, information society and the fourth generation of Multimedia and Internet. We have witnessed over the last ten thousand years of our evolution the unfolding of the human potential.

• *A long projection*. It's not possible to move confidently into the future from a standing start (the present). Historian Arnold Toynbee uses the metaphor of trying to see yourself in a mirror with your nose pressed against it. You have to stand back to see clearly. We must go back into the past to take a long run at the future. Putting history into a pre-historical context provides an even longer projection to help us move confidently into the future with less fear and more hope [GARDINER 2006].

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[7] Looking back now on the Summer 1983 issue of Journal of Communication, entitled "Ferment in the Field", we can see that it was a Tempest in a Teacup [JOURNAL OF COMMUNICATION]. The central issue could be whimsically reduced to the question of whether communication studies should be a branch of political science (critical studies) or of business administration (administrative studies). The threat of dissolving into another discipline, which has always haunted the field, is now replaced by the opportunity to be the central discipline in the academy.

CHAPTER 6
FROM CHILD TO ADULT (PIAGET)

Intellectual development may be conceived as a kind of Toynbeean challenge-response affair: at selected points in his development, the socius thrusts the child into new roles with new and different sets of cognitive demands; the child responds to the challenge by acquiring the new cognitive structures needed to cope with these demands.

John H. Flavell
The Developmental Psychology of Jean Piaget

The first nine months of ontogenetic development was once considered as a high-speed rerun of phylogenetic development. For example, a fin-like structure in the human embryo was seen as representing our past in the sea. Ontogeny recapitulates phylogeny. Embryologists and paleontologists worked for half a century within this hypothesis, but the case for the **theory of recapitulation** was finally dismissed for lack of evidence.

There may, however, be certain formal similarities between ontogenetic and phylogenetic development. Both processes are characterized by continuous discontinuity. Charles Darwin argues that phylogenetic development is continuous with respect to function (organisms evolve through adaptation to the environment) but is discontinuous with respect to structure (different organisms evolve to fit different environments). Jean Piaget, like Darwin, views the function of the nervous system as the adaptation of the organism to the environment. However, he goes further by arguing that adaptation involves the alternating processes of assimilation (in which the organism takes in information from the environment) and accommodation (in which the organism adjusts its cognitive structure, if necessary, to assimilate this information). Thus, ontogenetic development is continuous with respect to function (the person adapts to the environment through alternating assimilations and accommodations) but discontinuous with respect to structure (different structures emerge over time to accommodate what is assimilated).

Piaget had to convince us of the discontinuity, since he had to fight the prejudice that a child is a miniature adult; Darwin had to convince us of the continuity, since he had to fight the prejudice that the human organism is unique. Piaget and Darwin have matured and humanized we adult humans by, paradoxically, showing us our affinity with children and with animals.

6.1 THE MAN

Jean Piaget was a precocious child. He published his first scientific paper at 10, refused an important position as curator of a museum at 14, and completed his doctorate at 22. Unlike many such fast starters, Piaget continued to outpace his peers and his times and was still precocious when he died in his eighties. No matter how precocious, however, he still went through the same stages of cognitive development in the same order as you and I. This is his theory.

Though Piaget was mainly interested in epistemology (the study of knowledge), he took his formal training in biology and, though he was trained in biology, he devoted his life's work to developmental psychology. It is career choices like this which drive guidance counsellors crazy. Superficially, his decisions could be attributed to chance. Visits to the Swiss countryside during his childhood triggered an interest in the flora and fauna around him. Hence the training in biology. A position in Binet's laboratory designing items for intelligence tests got him interested in the children's wrong answers. Hence the career in developmental psychology. However, Piaget's career was more consistent than it seems. Developmental psychology (the subject to which he devoted his life) is the missing link between biology (the subject in which he was trained) and epistemology (the subject in which he was primarily interested). That is, the link between the function of the nervous system (biology) and the content of the nervous system (epistemology) is the evolving structure of the nervous system (developmental psychology).

The theory of Jean Piaget may be as important as those of Charles Darwin and of Sigmund Freud. Whereas Darwin replaced the animal-human dichotomy with a dimension and Freud replaced the normal-abnormal dichotomy with a dimension, Piaget replaced the child-adult dichotomy with a dimension. It is interesting to note that those three who made revolutions did so by destroying, rather than by creating, dichotomies. However, though the Piagetian revolution is probably as important as the Darwinian revolution and the Freudian revolution, it is not as familiar.[1]

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[1] Nor is it as easy to pronounce. If you plan a revolution, make sure that you chose a name which is easy to pronounce with the -ian suffix. Darwinian, Freudian are easy on the tongue but not Piagetian. Gardinerian? - perhaps someone someday will grant me the Gardiner Guess.

It is not so familiar for a number of reasons. First, it is newer. A new theory tends to be greeted initially as preposterous ("*What!*") and eventually as obvious ("*So what?*"). The theories of Darwin and Freud have been around long enough to become obvious, whereas the theory of Piaget, while no longer preposterous, is not yet obvious. Second, it is difficult to understand. A new theory requires a new language. Piaget has developed an elaborate and idiosyncratic system of technical terms to state his theory. The usual difficulty of translating from French to English is compounded by the additional difficulty of translating from Piageteze to French. Third, it runs counter to the prevailing current. Piaget's method is uncongenial and his theory is unpalatable to the behaviorists who have dominated psychology.

However, Piaget's theory has recently, despite those disadvantages, become well-known to psychologists and educators. Indeed (perhaps, to the detriment of the theory and the embarrassment of the theorist) it has even become fashionable. Since the methods and theories of Darwin and Freud are more familiar, however, I will present those of Piaget by comparison with them. We will see that the method of Piaget is similar to that of Freud and that the theory of Piaget is similar to that of Darwin.

6.2 THE METHOD

Piaget, like Freud, used the **clinical method**. That is, he sought to understand people by listening to them. However, unlike Freud, he did not listen to adults talking about themselves as children. He had no faith in such retrospective accounts of childhood. Adults do not really know how it was to be a child - partly because their memory is too bad (it was so long ago and they have forgotten) and partly because their memory is too good (they "remember" things which never happened). Piaget himself "remembered" being kidnapped as a kid but later discovered that his "kidnapping" was merely a story invented by his nursemaid to explain some scratches on his face.

The main basis for his lack of faith is his own theory. As children develop into adults, they go through qualitative changes which make it impossible for them to think as they thought as children. Development is more like going up a set of stairs than going up a ramp - you can't see the

previous stairs clearly by looking back. Unlike our physical growth, our mental growth involves qualitative rather than merely quantitative changes. We go through transformations. Our mental growth is like the physical growth of the tadpole into the frog or the caterpillar into the butterfly. Perhaps we are as unaware of our previous selves as the butterfly is of its career as a caterpillar.

Piaget listens to *children* talk about themselves as children. Here, for example, is a child of 5 years, 9 months talking, with some prompting from Piaget, about dreaming [PIAGET 1929]:

Where does the dream come from?
I think you sleep so well that you dream.
Does it come from us or outside?
From outside.
What do we dream with?
I don't know.
With the hands? With nothing?
Yes, with nothing.
When you are in bed and you dream, where is the dream?
In my bed, under the blanket. I don't really know.
If it was in my stomach (!) the bones would be in the way and I shouldn't see it.
Is the dream there when you sleep?
Yes, it is in the bed beside me.
Piaget tried suggestion:
Is the dream in your head?
It is I that am in the dream: it isn't in my head
When you dream, you don't know you are in the bed. You know you are walking. You are in the dream. You are in bed but you don't know you are.
Can two people have the same dream?
There are never two dreams (alike).
Where do dreams come from?
I don't know. They happen.
Where?
In the room and then afterward they come up to the children. They come by themselves.
You see the dream when you are in the room, but if I were in the room, too, should I see it?
No, grownups (les Messieurs) don't ever dream.
Can two people ever have the same dream?
No, never.

When the dream is in the room, is it near you?
Yes, there!
(pointing to 30 centimeters in front of his eyes).

Sometimes Piaget would create a concrete situation as a basis for his conversation with a child. In the following example, he deflates a punctured rubber ball, directing the jet of air toward the child's cheek, and asks the child where the air comes from and where it goes. The child in this sample conversation is 8 years, 6 months old [PIAGET 1930].

What is happening?
There is air. Because there is a hole, then it comes out.
Where does the air come from?
They put it in.
Who?
The man. The man took the ball and put air into it.
*T*he ball is deflated and allowed to fill itself again:
It is coming back.
How?
By the hole.
But where from?
It is going in.
Is it the air of the room that is going in, or the air that I took away?
The air that you took away.

Piaget may invite the child to act as well as to talk. In the following example, he puts six counters in a straight line with equal spaces between them and asks the child to pick out of a box the same number of counters. The child in this sample conversation is 4 years, 5 months old [PIAGET 1952].

Take the same number as there are there (6 counters).
(He put 7 counters close together, and then made the correct correspondence)
Are they the same?
Yes.
(His row was then spread out)
Are they the same.
No.
Has one of us got more.
Me.
Make it so that you have the same number as I have.
(He closes his up)
Are they the same?
Yes.

Why?
Because I pushed mine together.

In the case of very young children who can't talk, Piaget can, of course, only invite them to act. Here is a description of one of Piaget's interactions with his daughter Jacqueline, when she was 1 year, 6 months old [PIAGET 1954]:

> Jacqueline is sitting on a green rug and playing with a potato which interests her very much (it is a new object for her). She says "*poterre*" and amuses herself by putting it into an empty box and taking it out again. --- I then take the potato and put it in the box while Jacqueline watches. Then I place the box under the rug and turn it upside down thus leaving the object hidden by the rug without letting the child see my maneuver, and I bring out the empty box. I say to Jacqueline, who has not stopped looking at the rug and who has realized that I was doing something under it: "*Give Papa the potato*". She searches for the object in the box, looks at me, again looks at the box minutely, looks at the rug, etc., but it does not occur to her to raise the rug in order to find the potato underneath.

By really listening to what children are saying and by carefully watching what they are doing, in many interactions such as those over half a century, Piaget gained a glimpse into the mind of the child. Children tell him their secrets in words and show him their secrets in actions. As we shall see, Piaget is often surprised at what they show and tell him.

Piaget may have been surprised by the children but psychologists were shocked by Piaget. The prevailing method in psychology is not his clinical method but the **experimental method**. Since he had never taken a course in psychology, Piaget did not know how he was supposed to do psychological research. Even if he were to have taken a course at the height of his fame, he would probably have flunked. He breaks all the hallowed rules of the hallowed halls. He does not review the relevant experiments of his colleagues or conduct experiments of his own. He does not set up precise hypotheses and the level of significance at which they will be knocked down. He does not select a careful sample of subjects. He does not manipulate an independent variable, control extraneous variables, and observe the effect on a dependent variable. In short, he does not use the experimental method.

Let us look in turn at the various rules Piaget breaks and his rationale (or rationalization?) for breaking them.

• Piaget makes no attempt to review the relevant literature except for occasional references to his own previous work. But --- he ties his own work together beautifully and then ties this work to other disciplines. Every aspect of development from thumb-sucking in the new-born infant to problem solving in the adolescent is included within the same coherent framework and is anchored solidly to biology on one side and to epistemology on the other. A man can afford to be an island when he is a continent.

• Piaget does not specify dependent and independent variables nor control extraneous variables. He seems to think that all variables should be interdependent and certainly that no variable should be controlled. He conducts demonstrations rather than experiments. But --- the clinical method is more appropriate than the experimental method. In the clinical method, the behavior of the child determines the procedure of the psychologist, whereas in the experimental method, the procedure of the psychologist tends to determine the behavior of the child. The experiment often reveals more about the thinking of the experimenter than about the thinking of the subject.

• Piaget seldom uses statistics or specifies the number of subjects in his sample or the method by which they were selected. But --- sampling and statistical techniques are required only in studying superficial variables. No one questioned the generalization of heart transplants merely because the first patient was only one individual and a South African. Piaget is dealing with such basic cognitive processes in species Homo sapiens that what is true of his daughter Jacqueline can reasonably be said to be true of all children.

• Since he is using the clinical rather than the experimental method, Piaget can provide only mere descriptions, and not explanations, of phenomena. But --- there is nothing "mere" about description. "*E equals MC squared*" is a description. Descriptive studies of development have fallen into disrepute merely because, in unimaginative heads, they have produced only variations of the proposition that "*kids get better at doing things as they get older*". Piaget has made descriptive studies of development respectable again.

• In summary, Piaget might argue as follows: The experimental method is indeed a powerful instrument which has contributed a great deal to our understanding of our world and of ourselves. The logic of the experiment is impeccable. If you vary the independent variable,

control all the extraneous variables, and observe any significant change in the dependent variable, then you can say that your manipulation of the independent variable is cause and the change in the dependent variable is effect. Such cause-effect relationships are the basic building blocks of science. But --- what is questionable, however, is not the logic of the experiment but the assumption that this logic is appropriate for the study of all phenomena. It is not the logic used in thinking by children nor is it the most appropriate logic for the study of thinking by children. The experimental design is determined by the prejudice of the experimenter about how children think. This forces children either to think how the experimenter thinks they should think or to perversely continue to think how they do think (causing the experimenter to stomp off muttering about confounding variables and confounded children).

In order to preserve the spontaneous thinking of the child, it is necessary to use the clinical method, in which the behavior of the child determines the behavior of the adult. If you want to know how children think, you ask them - you don't tell them. This would seem obvious. You can't get to know by assuming that you already know. You ask them but you don't ask them directly: "*Hey, kid, are you adapting to your environment through alternating assimilations and accommodations?*" They don't know how they think either. Indeed, I don't know how I think and you probably don't know how you think. However, children think without knowing how they do it just as cows transform grass into milk without knowing how they do it.

Children are, in a sense, the world's foremost authorities on thinking as children and Piaget was the world's foremost authority on thinking about children thinking as children. So they work together. Children think and Piaget thinks about their thinking. Piaget and his army of children have, together, developed a coherent and comprehensive description of cognitive development from child to adult. They have painted in bold, broad strokes the general outline of the cognitive development of our species and another army of disciples, ably led by Piaget's long-time colleague, Barbel Inhelder, are filling in the details.

6.3 THE THEORY

Developmental psychology was described above as the link between the two apparently unrelated subjects of biology and epistemology. Developmental psychology is concerned with the structure of the nervous system, whereas biology is concerned with its function and epistemology with its content. Let us look in turn at function, structure and content to see how structure links function to content.

Piaget, like Darwin, considers the function of the nervous system to be the **adaptation** of the organism to its environment. Adaptation involves the complementary processes of **assimilation** and **accommodation**. The nervous system assimilates information from the environment and, if necessary, accommodates to that information.

The process of cognitive development is like the progress of a worm, as it stretches its front forward and then pulls its back up. The alternating stretches and pulls of the worm correspond to the alternating assimilations and accommodations of the person. But what moves us to stretch and pull? The spate of evidence for a need for stimulation and a need for consistency, as presented in Section 3.2, suggests the organic basis for assimilation and accommodation, respectively. We assimilate information from our environment because we have an need for stimulation and we change to accommodate that information, if it is not consistent with the information already stored, because we have a need for consistency.

Because of the need for consistency, the stored information is organized into a structure. Input information, which is inconsistent with this stored information, forces changes in this structure if this new information is to be accommodated. When the structure changes qualitatively, the child is said to move into a new stage. There are three broad stages corresponding to three basic structures - the **sensorimotor stage** (up to 2 years), the **concrete operations stage** (2 to 11 years) and the **formal operations stage** (after 11 years). This is, of course, a very bold, bald statement - there are substages and sub-substages within each stage, the transition from one stage to another is not abrupt, and the stages are not tied rigidly to ages.

The content of your nervous system is the product of this process of alternating assimilations to and accommodations of those evolving structures. Your content is all the information you have assimilated from

your environment. This information is not, however, simply poured in - it is assimilated into an organized structure of previous information and that structure may have to change to accommodate it. Thus, structure serves to mediate between function (adaptation through alternating assimilations of and accommodations to information from the environment) and content (information assimilated by the person from the environment).

Now that we have the developmental psychology of Jean Piaget firmly anchored, on the one side, to biology, through the function-structure relationship, and, on the other side, to epistemology, through the structure-content relationship, let us take a closer look at it. We have learned so far that, as a different structure emerges, the child is said to move into a different stage, and that the three major stages are sensorimotor, concrete operations, and formal operations. Here is a description of you during each of those stages.

In the sensorimotor stage, you live in the here and now. Not because your guru recommended it but because you have no option. Living in the there and then requires some internal representation of things which are not here and now, and you have as yet no such internal representation of your environment. You are interested in your environment only insofar as it is doing things to you (sensory) and you are doing things to it (motor) - that is, you are in your sensorimotor stage. The behaviorists are right. You are an S-R organism - but only up to the age of 2. Your task during your first two years is to co-ordinate stimuli and responses - stimulus with stimulus, stimulus with response, and response with response. Let us look at each in turn.

Co-ordinating stimulus with stimulus involves the acquisition of the **object concept** and of **object constancy**. You now perceive your world as composed of objects, which continue to exist even when you are no longer looking at them (object concept) and which remain the same despite the different ways you look at them - that is, they remain the same size despite variation in your distance from them, the same brightness despite variation in the illumination on them, and the same shape despite variation in your orientation to them (object constancy). That is, you believe that the Statue of Liberty is still in New York harbor, where you last saw it, even though you are now back home in Klamath Falls, Oregon, and you believe that it will continue to be 150 feet high, even if it were shipped back to France.

It is difficult to imagine how the world could be perceived otherwise. Yet children do, and you as a child did. When Piaget presented his

daughter Jacqueline with a bottle, she made the appropriate reaching motions and gurgling sounds as long as she could see it, but lost interest in it when he put it behind his back. Out of sight, out of mind. This faith that an object exists independently of you (object concept) is a prerequisite to the faith that it conserves its size, brightness and shape despite variation in distance, illumination and orientation (object constancy). It was one of your accomplishments during your sensorimotor stage.

Stimulus and response get co-ordinated through a series of **circular reactions**. Between 1 and 4 months, you develop **primary circular reactions**. You happen to make the sound "ah" (response), you hear the sound (stimulus), you imitate the sound (response), you hear the sound again (stimulus), and so on as you imitate yourself over and over again.

Between 4 and 8 months, you develop **secondary circular reactions**. You happen to make the sound "dah" while doting daddy is present (response), you see daddy jumping up and down with excitement at being recognized (stimulus), you repeat the sound (response), daddy jumps up and down some more (stimulus), and so on in that eternal process by which two generations continue to condition one another. Whereas your primary circular reaction was centered on yourself, this secondary circular reaction is centered on your environment. It is, in Piaget's words, "*behavior designed to make interesting sights and sounds last* ". You have started to act on your environment. However, your behavior is not yet intentional, because you have not yet disentangled your means (your response) from your ends (to make interesting sights and sounds last). You shake your rattle in order to produce those interesting sounds but, if your rattle were taken away, you would continue to shake your arm.

Between 12 and 18 months, you develop **tertiary circular reactions**. As before, you repeat a behavior which has an interesting effect, but you vary that behavior to discover what changes there will be in that effect. Thus, your babbling is not just "ah, ah, ah, ah, ah" as you imitate yourself in the primary circular reaction, nor just "dah, dah, dah, dah, dah" as you perpetuate an interesting effect in the secondary circular reaction, but "ah, dab, mah, maaah, damaa, daaa" as you vary your response to test their effect on your environment. You are conducting experiments; you are beginning your career as a scientist. You are not simply behaving in order to behave but are behaving in order to check out your environment. Behavior was an end in itself but is now a means to another end.

One President of the United States is reported to have said of another that he couldn't both walk and chew gum at the same time. This is

true of all of us at birth. You learn to co-ordinate your responses during the sensorimotor stage. You are born with a small repertoire of inborn responses or reflexes - you can look at things, you can reach for things, you can grasp things, you can suck on things. During your first month, you exercise each of those reflexes individually - you look at, reach for, grasp, or suck on things. However, you can't simultaneously look at and reach for a thing or successively look at, reach for, grasp, and suck on a thing. Your set of isolated responses are not organized into systems of responses until about 8 months. You know things in your environment purely in terms of your organized systems of responses to them. By 18 months, you begin to represent those things by a organized system of internal responses. Such an internal representation of your external environment heralds the beginning of mental life and the end of the sensorimotor stage.

As you move from the sensorimotor to the concrete operations stage, your behavior is determined not only by your external environment but also by your internal representation of your external environment. This internal representation is made possible by the development of the **symbolic function**. That is, you learn to represent an object in your environment by something else. An object (for example, a gun) may be represented by another object (a stick), a gesture (pointing a finger), a sound (bang! bang!), an image (a drawing of a gun), or a word ("gun"). Note that the word is only one of many possible representations of an object. The development of the symbolic function is a necessary condition for the development of language and not vice versa, as some theorists have argued.

The concrete operations stage can be subdivided into pre-operational and operational substages. Sometimes, the pre-operational substage is presented as a separate stage. However, I prefer to include it within the concrete operations stage, since what is essentially a pre-sensorimotor substage is included within the sensorimotor stage. Just as the sensorimotor child must practice the isolated responses before organizing them into a system, so the concrete operations child must practice the isolated internal representations before organizing them into a system. The pre-operational substage may perhaps be best considered as this preparatory phase of practice.

The pre-operational substage can be described in terms of the "mistakes" you make as you first explore your new, confusing world of symbols. Piaget illustrates two such mistakes in the following anecdotes about his children [PIAGET 1951]:

When walking with his son, they passed a snail.

"*There is a snail*", said his son.
Later, they happened to pass another snail.
"*There is the snail again* " said his son.

Jacqueline, seeing her sister Lucienne in a new bathing suit with a cap, says to her mother:
"*What's the baby's name?*"
Her mother explained that it was a bathing costume.
However, Jacqueline pointed to Lucienne's face and asked: "*But what's the name of that?*" repeating the question many times.
As soon as Lucienne had her dress on again, Jacqueline said very seriously:
"*It's Lucienne again* " as if her sister had
changed her identity by changing her clothes.

The first "mistake" (different members of a class - snail 1 and snail 2 - in different contexts are the same member) and the second "mistake" (the same member of a class in different contexts - Lucienne-in-bathing-costume and Lucienne-in-dress - are different members) both illustrate that the child has concepts. The snails are fitted into the appropriate class of "snail" and Lucienne into the appropriate class of "baby" - but the rules for dealing with the relationship between individual objects and classes of objects are not yet clear. When you reach the operational substage, those mistakes are corrected. You know that objects can be members of the same class yet different objects and that an object may change contexts yet remain the same object. You can fit objects into classes and consider the relationship between those classes. That is, you are capable of **class reasoning**.

In the following experiment, Piaget illustrates another competence you gain as you move from the pre-operational to the operational phase of the concrete operations stage [PIAGET 1952]. Children are shown 10 dolls of differing heights and 10 miniature walking sticks also of differing lengths. They are asked to arrange dolls and sticks "*so that each doll can easily find the stick that belongs to it* ". Pre-operational children could not place the dolls or the sticks in order. They seemed to lack any organizing principle for ordering objects - for example, finding the tallest doll, then the next tallest doll, and so on until the series is complete. They did not understand the principle underlying this procedure that, if doll A is taller than doll B and doll B is taller than doll C, then doll A is taller than doll C.

There was a transitional stage during which the child could order the dolls and the sticks but could not assign the sticks to the dolls unless they were lined up evenly with them. If Piaget squeezed the row of sticks closer together or spread them further out, then they could no longer tell which stick belonged to which doll. Finally, in the operational substage, the child could order both the sticks and the dolls and could assign the correct stick to each doll. At this point, you can place objects along dimensions and consider the relationship between objects along those dimensions. You are capable of **ordinal reasoning**.

In summary, at the end of the concrete operations stage, you are capable of both class reasoning and ordinal reasoning. That is, you can place objects in your environment into classes and along dimensions. On this firm foundation of logic, you are now ready to build the superstructure of mathematics. Now that you know "doll A is taller than doll B" and "doll B is taller than doll C" imply that "doll A is taller than doll C", you may be interested in making the more precise statement than "doll A is x units taller than doll B" and "doll B is y units taller than doll C" implies that "doll A is x plus y units taller than doll C". The natural numbers (1, 2, 3, --) make this possible. By placing those numbers evenly along your dimension, you can now see that dolls A, B, C are, let us say, 9, 7, and 4 units tall, respectively. Thus, "doll A is 2 units taller than doll B" and "doll B is 3 units taller than doll C" which implies that "doll A is 5 units taller than doll C".

Within this system of natural numbers, you can add and always get an answer. However, when you reverse this operation and subtract, you can't always get an answer. Mathematicians invented zero to provide an answer when you subtract a number from itself and negative numbers to provide an answer when you subtract a number from a smaller number. When you multiply within this enlarged system of numbers, you can always get an answer. However, when you reverse this operation and divide, you can't always get an answer. Mathematicians invented fractions to provide an answer when you divide a number by another number which does not divide evenly. When you square within this system of numbers, you can always get an answer. However, when you reverse this operation and take the square root, you can't always get an answer. Mathematicians invented irrational numbers to provide an answer when you take the square root of a number which is not a perfect square.

In this way, more and more systems of numbers are invented to permit closure under more and more sophisticated operations and thus the superstructure of mathematics is erected. However, no matter how

esoteric it becomes, it still rests on the foundation of class and ordinal reasoning and cannot be assimilated by you until you have mastered those basic logics. Having mastered concrete operations, you now have the basis for learning mathematical operations. You cannot yet deal, however, with some of the products of those operations - with negative numbers, irrational numbers, and imaginary numbers (the square root of irrational numbers), because there is no concrete equivalent to them. You can deal with 5 oranges but not with -3 oranges or √7 oranges or √-2 oranges. You can see, smell, touch, and taste an orange but not a negative, irrational, or imaginary one.

If I were to hand you three dolls called Mary, Sue and Jane with Mary being taller than Sue and shorter than Jane, then you would be able to line them up in order of height and tell me that Jane is the tallest of the three. However, if I were to tell you that "Mary is taller than Jane and shorter than Sue" and asked you "Who is the tallest of the three?", you would have great difficulty in answering. You can solve the problem in your hands but not yet in your head, in much the same way as, at one point, you could count on your fingers but not in your head. That is, you can perform operations on concrete objects but not yet on propositions about those objects. Your internal representation of your environment helps you deal more effectively with it but you are not yet emancipated from it. You are capable of class reasoning and ordinal reasoning but not yet of **propositional reasoning**.

The following one-minute course in propositional reasoning will serve to show what you gained when you moved from the concrete operations stage to the formal operations stage. First, try the short test in propositional reasoning provided in Figure 6-1.

Let us imagine an empty universe and let us introduce into it the proposition. In the beginning, there was the proposition. At the risk of appearing unduly familiar at such early acquaintance, let us call it simply p. Propositions come in many guises - today is Tuesday, Now is the time for all good men to come to the aid of Jennifer 343-7020, Kafka is a kvetch, E equals M.C squared, and so on - but they all have in common the fact that they may be said to be either true or false. Let us represent this fact, in shorthand, as p or -p, where p means proposition p is true and -p means proposition p is false. Our proposition looks lonely all alone in its empty universe. Let us then introduce another proposition, q, which, like all propositions may be said to be either true or false. If those two propositions get together, as inevitably they must all alone in their empty universe, they will generate four possible states of affairs:

p is true and q is true
p is true and q is false
p is false and q is true
p is false and q is false

Those possibilities can be represented in shorthand as

p.q or p.-q or -p.q or -p.-q

There are certain words in the English language, called **logical operators**, which provide the means of eliminating every possible subset of alternatives from this set of four possible states of affairs in a universe containing two propositions. For example, when we say "not both p and q", we are eliminating the first alternative; when we say "if p, then q", we are eliminating the second alternative; when we say "either p or q", we are eliminating the first and fourth alternatives; when we say "neither p nor q", we are eliminating the first, second, and third alternatives.

A certain subset of propositions (for example, "This is a typewriter", "I am a Scotsman") state that a particular object is a member of a set. Because such propositions occur so often, the cumbersome "If X is a member of set A, then X is a member of set B" is compressed to "All As are Bs". The relations "Some As are Bs" and "No As are Bs" can be generated in the same way. Class reasoning, involving those relations "all", "some" and "no", permits you to place the things in your environment into sets and consider the relationships among those sets. The subset of propositions stating the position of a thing on a dimension generates, in a similar way, the relations "is greater then", "is equal to", and "is less than". Ordinal reasoning, involving those relations, permits you to place the things in your environment along dimensions and consider the relationships between their positions on those dimensions. In your concrete operations stage, you could deal only with those two limited subareas of propositional reasoning - class reasoning and ordinal reasoning - because they refer directly to things in your environment. In your formal relations stage, you learn how to operate with propositions as well as with things and can thus deal with all propositional reasoning.

1 Suppose you know that
If I have a marble in my right hand,
then I have a marble in my left hand.
I have a marble in my right hand.

Then would this be true?
I have a marble in my left hand. YES NO MAYBE

2 Suppose you know that
If I have a marble in my right hand,
then I have a marble in my left hand.
I have a marble in my left hand.

Then would this be true?
I have a marble in my right hand. YES NO MAYBE

3 Suppose you know that
If I have a marble in my right hand,
then I have a marble in my left hand.
I do not have a marble in my right hand.

Then would this be true?
I have a marble in my left hand. YES NO MAYBE

4 Suppose you know that
If I have a marble in my right hand,
then I have a marble in my left hand.
I do not have a marble in my left hand.

Then would this be true?
I have a marble in my right hand. YES NO MAYBE

You may now use the following strategy to check your answers to the short test in propositional reasoning in Figure 6-1: The premises (the propositions after SUPPOSE YOU KNOW THAT) eliminate certain alternatives from the four possible alternatives, and the status of the conclusion (the proposition after THEN WOULD THIS BE TRUE?) is determined by the remaining alternatives.

If it is contained in all the remaining alternatives, then it must be true (YES);

if it is contained in some of the remaining alternatives, then it may be true (MAYBE);

if it is contained in none of the remaining alternatives, then it can't be true (NO).

The answers then are
1 YES 2 MAYBE 3 MAYBE 4 NO.

	p is true		**q is true**	
	p is true or **p is false**		**q is true** or **q is false**	
	p is true & q is true	**p is true & q is false**	**p is false & q is true**	**p is false & q is false**
1 If p is true, then q is true		X		
p is true			X	X
Therefore q is true **YES**				
2 If p is true, then q is true		X		
q is true				X
Therefore p is true **MAYBE**				
3 If p is true, then q is true		X		
p is false	X			
Therefore q is true **MAYBE**				
4 If p is true, then q is true		X		
q is false	X		X	
Therefore p is true **NO**				

FIGURE 6-1 A SHORT COURSE IN LOGIC

The propositions need not be about concrete things in your environment. They can be purely abstract (if p, then q. p. Therefore, q) or nonsensical (if missons are stubils, then they are slevible. Missons are stubils. Therefore, missons are slevible) or, even, contrafactual (If mice have

five legs, then they run faster than horses. Mice have five legs. Therefore, they run faster than horses). The conclusion follows from the premises in each case because of the structure of the argument. The content does not matter. You are finally emancipated from your environment.

The Jean Piaget Archives, published in 37 volumes, contains over 50 books and over 500 articles [JEAN PIAGET FOUNDATION]. It is presumptuous to try to compress this huge body of data based on a lifetime of work into a chapter and it is very presumptuous to try to summarize it in a paragraph. Here is a very presumptuous paragraph.

Your cognitive development was not, as it appears when you look back on it, a gradual accumulation of information and skills. It was a series of revolutions in which you moved from one stage to another. "*Each stage is qualitatively different from every other, but each results from the one that preceded it, and prepares (you) for the one that follows it*" [LEFRANCOIS]. First, you deal directly with your environment (sensorimotor stage), then with propositions about your environment (concrete operations stage), and then with propositions about propositions (formal operations stage), You free yourself from the tyranny of your environment by acting on it and, thereby, building up an internal representation of it. Your behavior is subsequently determined not only by your objective environment but also by your subjective map.

6.4 THE IMPLICATIONS

Piaget is an interactionist. His theory clearly places the inside-out process of growing as primary and the outside-in process of conditioning as secondary. The child is unfolding naturally from the inside-out but will not do so unless that process is "fed" by appropriate information from the outside-in.[2] The "food" is, however, best provided as a smorgasbord than as the traditional set menu. When presented with an all-you-can-eat buffet, children will demonstrate a healthy appetite and will select a balanced

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[2] When he presented that unfolding process at Cornell University during my time as a graduate student, the first question he was asked was *"how do you speed it up?"* He took his pipe out of his mouth and said *"Ah, the American question!"* Apparently this is the first question he was always asked when talking to a North American audience. His answer was, essentially, that one should let the process unfold and not rush it.

diet. Teachers need not talk down to them because they are small nor force-feed them because they are reluctant to eat. However, they do need to know how best to serve the smorgasbord. Teachers communicating with young children are like anthropologists in their own culture dealing with people who are more different from themselves than adults in other cultures. For example, information must be presented to younger children in concrete form. Many children get turned off mathematics because it is presented too abstractly too soon.

This vision is, perhaps, best presented, somewhat whimsically, by telling a story of three Wise Men bringing gifts to a child - or to anyone who has ever been a child. The first Wise Man is Jean Piaget. His gift is the theory described above. The second Wise Man is Seymour Papert. His gift is a language. A student of Jean Piaget, he and his colleagues at the Massachusetts Institute of Technology (MIT) developed a computer language called **Logo**, which would enable computers to facilitate human development, as described by Piaget. Logo played a central role in two brilliant books on education [PAPERT 1980, 1993]. The third wise man is Guy Montpetit. His gift is the distribution to the general public of a disk containing the Logo language. A student of both Piaget and Papert, he returned home to Montreal to found Logo Computer Systems Inc. (LCSI) to manufacture and distribute software using the Logo language.

Papert first "taught" his language to a mechanical "Turtle" attached to a keypad. A child (of whatever age) would type FORWARD 40 and the Turtle would take 40 turtle steps forward, leaving a trace of its trip with a pen on a paper on the floor. The child may then type RIGHT 90 and the Turtle would turn 90 degrees to the right. Using four basic words in the Logo language (FORWARD, BACK, RIGHT, LEFT), the Turtle can be instructed to draw any shape on the paper. Let us imagine that a child has commanded the Turtle to draw a triangle, then a square, then a pentagon, and so on. The child may already have discovered the Total Turtle Trip Theorem - that is, regardless of the shape of the figure, the turtle must turn a total of 360 degrees to get back to the position in which it started. This is only one of many insights into geometry the child could get using only those four simple words. Let us say that the child now wishes to teach the Turtle how to draw a circle. The Logo teacher may encourage the child to "think Turtle". This could help the child realize that the Turtle will have to go forward a little, turn a little, many times. Few children would have the patience to key in FORWARD 1, RIGHT 1 360 times. No child would be willing to repeat this chore every time he/she wanted the Turtle to draw a circle. This brings us to the third Wise Man.

Montpetit replaced the mechanical Turtle on the floor by a triangle on a screen and the keypad by a keyboard. A disk, supplied by LCSI, could be considered as the "mind" of the Turtle. It mediates between you at the keyboard and the Turtle-triangle on the screen. It solves the two problems mentioned above. The first problem of repeating FORWARD 1 RIGHT 1 360 tedious times is solved by simply typing REPEAT 360 (FORWARD 1 RIGHT 1). REPEAT is another Logo word which the Turtle "understands" because it is programmed into the disk. The second problem of repeating this command every time you want a circle is solved by teaching the Turtle a new word. This is done as follows:

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TO CIRCLE
REPEAT 360 (FORWARD 1 RIGHT 1)
END
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TO CIRCLE tells the turtle that you are about to teach it a new word, which will be called CIRCLE. REPEAT 360 (FORWARD 1 RIGHT 1) teaches it the "meaning" of the word CIRCLE. END tells the Turtle that you have finished defining the new word. Now, when you want a circle, you simply type CIRCLE.

One of the best ways to understand the relatively unfamiliar concept of a computer language (Logo, BASIC, etc.) is by analogy with the more familiar concept of a natural language (English, French, etc.). A natural language, the linguists tell us, consists of a hierarchy of units and sets of rules for combining acceptable units at one level to create meaningful units at the next level. What's that? Linguists don't talk too clearly. Figure 5-1 may help make this more concrete. A natural language consists of phonemes (roughly corresponding to letters) which can be combined, according to the rules of vocabulary, to yield morphemes (roughly corresponding to words) which can be combined, according to the rules of grammar, to yield sentences which can be combined, according to the rules of logic, to yield discourses. The structure of a computer language is essentially the same. Thus, learning a language, whether natural or artificial, consists largely of learning those acceptable units and the appropriate rules of vocabulary, grammar, and logic to combine them into units at the next level.

Though they have essentially the same structure, there are some interesting differences between Logo and English.

- Logo is an artificial rather than a natural language.

Logo was developed mechanically from the outside in, whereas English grew organically from the inside out. It was consciously developed for a

specific purpose - to talk to computers, or, more accurately, to talk to computer programs or, more whimsically, to talk to Turtles or to Turtles which had been transformed into triangles.

- Logo is typed rather than talked.

It is not possible to talk to computers, computer program, or Turtle-triangles (at least, not yet). You can't yet write to them either (you can, if you like, but you won't get an answer). You can, however, type to them and they can type back. The set of characters (corresponding to the phonemes in a natural language) are all on the keyboard. The Logo language is designed so that you can talk-type on the keyboard to the Turtle, represented by a triangle on the screen, and the Turtle can talk-type back to you on the screen.

- You can invent new Logo words.

The Turtle has a basic vocabulary of Logo words, which it can understand. You could think of them as the instincts of the Turtle. However, you can teach the Turtle new words (as we saw above in teaching the Turtle the meaning of CIRCLE). You can, of course, invent new words in English. However, they will be of no value in communication, except with those people to whom you teach their meaning.

- Your sentences in Logo tend to be commands.

Sentences in English can be roughly classified as statements (followed by a period), questions (followed by a question mark) and commands (followed by an exclamation point). When you talk Logo to the Turtle, you tend to use commands and the Turtle tends to use questions. It is like a conversation between a Sergeant-Major and a Private.

- Logo is more precise and concise than English.

When talk-typing to the Turtle, you must talk very precisely. The Turtle is not very smart. It will not understand you unless you type exactly what you want. You can also talk very concisely. Most Logo words have a shorthand version - e.g. FORWARD can be written FD and RIGHT can be written RT. You can, of course, do the same in English (e.g. TELEVISION can be written TV and MOdulator-DEModulator can be written MODEM). However, since it takes longer to type than to talk, this practice is more common in Logo than in English.

Logo differs, in a number of ways, from various traditional computer languages (FORTRAN, COBOL, BASIC, etc.). Those languages were created at a time when computer memory was very expensive. They are therefore designed to conform to the requirements of the machine

rather than of the person. BASIC is a brave attempt to consider the needs of the person by simplifying FORTRAN so that it is easy to learn. It is not, however, easy to use. Nor is it powerful enough for complex programs. Thus, one must learn BASIC to do simple programming and, then, learn FORTRAN to do complex programming.

Logo, on the other hand, was specifically designed to help children learn to learn. It is simple yet powerful. Thus, it has a very low threshold and a very high ceiling. *Turtle Geometry***,** an undergraduate textbook, starts with a first few fumbling turtle steps and ends with Einstein's General Theory of Relativity [ABELSON & DISESSA]. At first, Logo could be used only in laboratories with very large computers. However, now that home computers are becoming smarter and smarter and cheaper and cheaper, Logo can be made available to the general public.

A language like Logo, which is based on child development, is easier to learn and to use than languages like FORTRAN, which are based on engineering. It is designed for people rather than for machines. There is, however, another reason why it is better to "talk" Logo rather than FORTRAN. Benjamin Lee Whorf has argued that the language we speak determines the way we think [WHORF]. Though this theory is very controversial, there is considerable evidence that language determines thought, in some aspects and to some extent. Perhaps, the computer language we use also determines the way we think.[3] A language designed for people would, therefore, have a more congenial effect on thought than a language designed for machines.

Many much more sophisticated computer languages have emerged since LOGO. However, it is important to preserve its emphasis on the concrete. It's obviously important for children in their concrete operations stage. Much of math phobia is due to the introduction of abstract mathematics during this stage and thus perpetually turning people off mathematics or requiring them to perform mathematical operations by rote without genuine understanding of its principles.

I once taught a gifted class in Grade 8 mathematics (I was the only one in the class who wasn't gifted!). Since, in elementary school, they had little difficulty with the math curriculum, teachers had enriched the curriculum by teaching them some algebra. To solve equations, they would recite a little mantra: "Put it over the other side and change the sign".

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3 My thanks to my friend, Gordon Sheppard, for this insight.

Thus if $X + 3 = 8$, then $X = 8-3 = 5$. However, $X/3 = 8$ would confuse them and $\sqrt{X} = 8$ would totally baffle them.

I had to teach them the basic principle in concrete terms: An equation is a balance and therefore, in order to maintain that balance, you have to do the same thing to both sides.

$X + 3 = 8$	$X/3 = 8$	$\sqrt{X} = 8$
$X + 3 - 3 = 8 - 3$	$X/3 \times 3 = 8 \times 3$	$\sqrt{X}^2 = 8^2$
$X = 5$	$X = 24$	$X = 64$

Many complained about the "extra" step but those who replaced their abstract mantra with this principle found that the concrete principle applied in all cases and guided them through very abstract algebra.

I met Guy Montpetit at a dinner party:.
"*Why don't you come to LCSI and help us with the documentation for the Atari Logo*.".
"*I don't know anything about computer languages. Indeed, I don't even understand what you just said*."
"*That's okay. We're looking for intelligent innocence*."
"*O. K*."
I found myself at a meeting with Seymour Papert on one side and Marvin Minsky (probably the world's foremost expert on artificial intelligence) on the other. I had the following conversation with myself: "*What am I doing here? You're being paid 300 bucks to listen to Seymour Papert talking to Marvin Minsky. Relax. Enjoy. Learn*." One of the ideas that emerged from that meeting was Logo Lego. Imagine building a truck and a crane with your Lego set and being able to program them with the Logo language. You program the truck to back into a particular position and the crane to pick up an object and place it in the bed of the truck. It misses. Back to the drawing board. Imagine what abstract principles a child (or anyone who has ever been a child) could learn in getting that concrete load into that concrete truck using that concrete crane.

CHAPTER 7
FROM BEHAVIOR TO EXPERIENCE

Whilst part of what we perceive comes through our senses from the object before us, another part (and it may be the larger part) always comes out of our own mind.

William James, **The Principles of Psychology**

I want to suggest that the concept of mind is the blur with which Western intellectuals become obsessed when they finally give up on the blur which was the theologian's concept of God. The ineffability of the mental serves the same cultural function as the ineffability of the divine - it vaguely suggests that science does not have the last word.

Richard Rorty, **Mind as Ineffable**

7.1 BEHAVIOR AND EXPERIENCE

The nervous system is unique among all systems in the universe, because it can be viewed from the inside (experience) as well as from the outside (behavior). A full description of the function of the nervous system must explain both behavior and experience. The view from the inside and the view from the outside overlap. However, there can be aspects of behavior which are not aspects of experience, and aspects of experience which are not aspects of behavior.[1]

Psychology *started* as the study of experience. Wilhelm Wundt, who founded the first psychological laboratory at Leipzig, Germany in 1879, was an **introspectionist**. His laboratory was the "in" place at the end of the last century. Students converged from around the world to sit at Wundt's feet and diverged again to spread the gospel. What was the gospel? Psychology is the study of experience. How is experience studied? By submitting oneself to a particular stimulus and observing one's experience. What is the aim of this study? To analyze experience into its constituent elements: sensations, feelings, images.

Thus, for example, if I were to say to you "*Add --- two and three*", you would probably respond "*five"*. What was your experience during the pause between add and two and three? If I had said multiply rather than add, you would have immediately responded with another answer. Something must have happened in your brain, then, between add and two and three, which set you to say five. If you observed images during this pause, you are a Titchenerian; if you did not observe images, then you are a Kulpian.

Edward Titchener and Oscar Kulpe were two students of Wundt, who got into a debate after Titchener went to Cornell University and Kulpe went to Wurzburg University. Kulpe claimed that it was possible to

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[1] For example, one of my students informed me that I finger the top of my fly from time to time during lectures. This may have been due to the fact that another student had once told me - after a two-hour lecture to 700 students - that my fly was open! However, I was not aware of this behavior. It was unconscious. Indeed, unconscious behavior could be defined as that which is part of behavior but not part of experience. On the other hand, I often am reminded of my mother when lecturing. To explain to her neighbors in my village in Scotland how I manage to survive while still going to school after allowed to leave, she says "*He lives by his wits - and he's on half salary*". If I don't articulate this thought, then it is part of my experience but not part of my behavior.

have thoughts without images. Titchener disagreed. There are images, said Titchener. There are no images, said Kulpe. There are so. There are not. There are so. There are not. There was no way to resolve this transatlantic debate. Titchener was the world's foremost authority on the experience of Titchener and Kulpe was the world's foremost authority on the experience of Kulpe.

John B. Watson headed the introspectionists off at this impasse. He published the manifesto of behaviorism in 1924 and, since then, most psychologists have been behaviorists, post-behaviorists, neo-post-behaviorists, or anti-behaviorists. What was his gospel? Psychology is the study not of experience but of behavior. How is behavior studied? By submitting a stimulus not to oneself but to a subject and by observing not your own experience but the subject's response. What is the aim of this study? To find the functional relationships between stimuli and responses.

As a graduate student at Cornell University, I was very sensitive to this introspectionist thesis and the behavioristic antithesis, since both persisted there side-by-side.[2] Courses in perception used the language of experience and courses in cognition used the language of behavior. Stumbling across **General Systems Theory (GST)**, I realized that the nervous system was unique among all the systems studied by science, because it can be observed from the inside (experience) as well as from the outside (behavior). A major theme of my career in the forty years since graduation, has been an attempt to create a synthesis of the thesis of the introspectionists and the antithesis of the behaviorists around the

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[2] The entrance to the Psychology Department was dominated by a huge portrait of E. B. Titchener, its founder, and Rosamund Valentine, the department secretary who was enthroned below it. There were no course requirements, but one had to pass a series of tests to demonstrate competence in each area of psychology. One of my early graduate experiences was approaching Rosamund about the results of two such exams. “Name?” “Gaaaardiner” She drew her finger down the Y-axis of a matrix in front of her and stopped. “Exam?” “Cooooognition” The finger moved along the x-axis and stopped. “Flunked!” I summoned up enough confidence to confess to having taken a second exam. “Peeeerception” The finger moved along and stopped. “Flunked again!” As I slunk away, I heard “That last flunk was a high flunk” I’ll always be indebted to J. J. Gibson for that high flunk - it kept me going.

By the way, I took a course from Ryan who was a student of Bentley who was a student of Titchener. Thus - as a student of Gardiner who was a student of Ryan who was a student of Bentley who was a student of Titchener who was a student of Wundt, who founded the first psychology lab - You are only five generations away from the beginning of psychology.

insight from GST that they provide inside and outside views of the functioning of the nervous system. Using another metaphor, the introspectionist and the behaviorist could be considered as two blind men, holding the tusk and the tail of the elephant, and generalizing to the whole elephant. This chapter is a rough sketch of the whole elephant drawn by a third blind man.

By depicting the person as the triple overlap of ecosphere (natural world), sociosphere (social world) and technosphere (artificial world), the Triad Model, depicted in Figure 3-1 focuses on the **objective world** of behavior with respect to those three aspects of the environment. However, each person at the centre has a **subjective map** of this objective world which partially determines this behavior. That is, our behavior is determined by the world-as-we-see-it rather than by the world-as-it-is. A tree in our objective world would not affect our behavior unless it becomes part of our subjective map. We could run into it if we did not see it. However, an enemy that we imagine to be lurking behind the tree would affect our behavior even though he is not really there. It is necessary then to add an inset to our model, depicting this subjective map (see Figure 7-1). This is the level of experience.

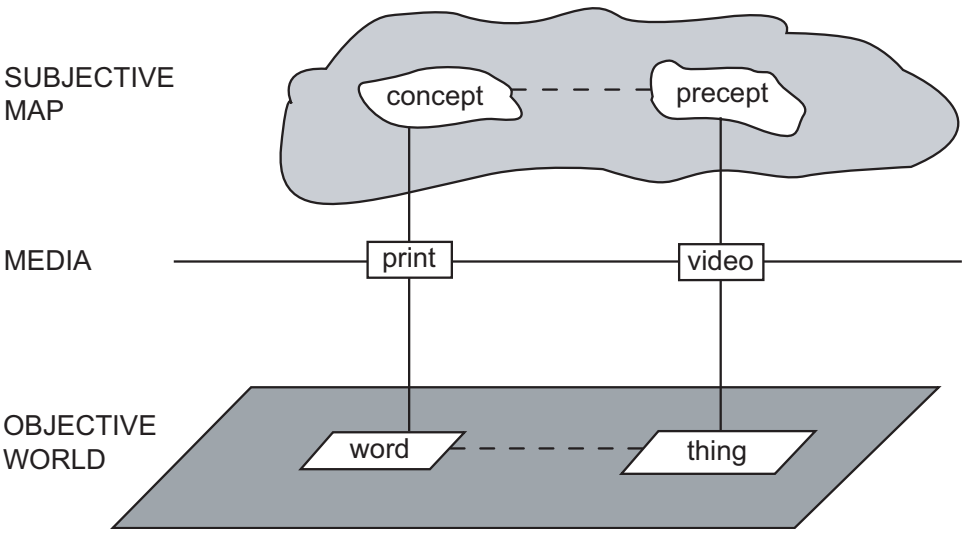

FIGURE 7-1 "MEDIA"TING BETWEEN SUBJECTIVE MAP AND OBJECTIVE WORLD

7.2 PERCEPTUAL AND CONCEPTUAL MAPS

The subjective map could be considered as composed of a **perceptual map** based on things in the objective world and a **conceptual** map based on words in the objective world. Since the speech centre is in the left hemisphere of the brain, it is a useful heuristic to associate the conceptual map with the left hemisphere. Despite the fact that I attended the university most famed for its research on perception, I still was taught that this **left hemisphere** was the "*dominant*" hemisphere. Since motor functions cross over, the left hemisphere controls the right side of the body. Most people are right-handed, right-footed, and right-eyed.[3]

The **right hemisphere** was viewed as a sort of spare in case there was damage to the dominant left hemisphere (based on the evidence that indeed if there was damage to the speech centre in early childhood, it could switch to the "*submissive*" right hemisphere). Now, it is clear that the right hemisphere is best considered as creating a perceptual map of the objective world.

Because of my traditional training, I strongly emphasize the conceptual over the perceptual map. An example of this is that I write directions when given them over the telephone (left side of Figure 7-2). When driving to visit my friend Sally, I had to stop a couple of times to reread my directions. In the interval between this first and a second visit, I had been thinking about my neglected right hemisphere. Hence, the next time she invited me, I drew a map as she was giving me directions (right side of Figure 7-2). This time I drove straight there, since I had a map in my mind. It is obvious to me now that nature is too parsimonious to create the most complex system in the world simply as a spare part and that the drawing of a map while getting directions clearly calls for the use of the right hemisphere.

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[3] We all know whether we are left or right-handed. If you are not from a soccer-playing country, you can find out whether you are left or right-footed by having a friend push you from behind when you are standing with your feet together and noticing which foot you put forward to regain your balance. You can find out whether you are left or right-eyed by lining up your thumb with an object with both eyes open. Now close your left eye. If the thumb is still aligned, you are right-eyed. That is, you had used your dominant eye to line it up even though you had both eyes open.

CONCEPTUAL MAP

23 Winston Circle
St. John South off 40
Lakeview Road
Belton Road
Winston Circle left
23 on right

PERCEPTUAL MAP

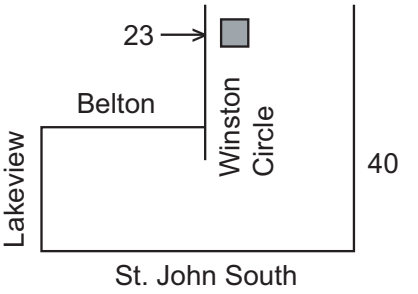

FIGURE 7-2 PERCEPTUAL AND CONCEPTUAL MAPS

When Barry Lucky gave me directions to his sound studio in the basement of his farm in Alexandria so that I could come to have my Siliclone pressed into a CD-ROM, I drew a map. Halfway there, I realized that I had left the map at home. My first reaction was to go back for it, but I discovered that I had the map in my head right down to the address of his farm and followed it right there.

My use of diagrams in this book - Figure 3-1 THE TRIAD MODEL, Figure 5-3 HOW THE MIND WORKS, Figure 10-1 FOUR GENERATIONS OF MEDIA and so on - further illustrates my attempt to learn to use my right hemisphere. Sometimes it is better to show than to tell. We have to learn to use our whole brain and not just the left side of its upper crust. We have to fire on all our cylinders. A picture is indeed sometimes worth a thousand words.

Another exercise to activate my dormant right hemisphere is to carry a small camera at all times. I have always carried a notebook for fishing in the stream-of-consciousness. That is, as the stream of consciousness is rushing past (or trickling past on bad days), I write down anything which is deemed interesting. My experience has been that we tend to forget even if it seems so unforgettable at the time. I'll always remember whatshername. From time to time, those notes are thrown into shoe boxes for each of the projects I'm working on. When it comes time to write that paper or give that lecture, more ideas emerge from that box than went into it. They've been breeding. Any new idea is a combination of old ideas.

Now, I carry a small camera to do the same for the perceptual map. It alerts me to interesting stills in the mind movie. My first small camera embodied the Advanced Photo System. This system has a number of features distinguishing it from the traditional 35 mm camera which has been essentially unchanged for decades. It is more compact. It uses cartridges which can be easily popped in and out of the camera. There are three optional aspect ratios - classical, hdtv, and panoramic. The photographs are returned with a colored contact sheet. You can receive the images on floppy disks or on CD-ROM disks as well as hard copies. Electronic messages keep you informed about the mode the camera is in, the number of shots remaining, and so on.

Those improvements in the design of the analogue camera are another illustration of the **sailboat effect**. The design of sailboats improved dramatically when the sailboat was challenged by the steamboat. The design of analogue photography improved because of the challenge from digital photography. While digital photography initially could not match the resolution of analogue photography, it was enough of a challenge to force the manufacturers of analogue cameras to finally improve them. In both cases, it was too little too late. Sailboats and traditional photography, like many obsolete technologies, shifted from tools to toys.

7.3 THE MIND MOVIE

There was a two-day graduation party in California for a friend. I was taking many photographs to build a souvenir album. I ran out of color film, borrowed some black-and-white film, and continue taking pictures with more abandon, since the film is cheaper. I ran out of black-and-white film, but continued with even more abandon with the empty camera. (It is now the afternoon of the second day!) Since there is not any record of the shots, I decide to abandon the camera and take shots simply by blinking. Suddenly I realized that there was little point in taking stills when I had a continuous movie going and - blinking no more - I sat back to enjoy the movie.

Every one of us is running a magnificent mobile movie studio of a mind, with wide-angle screen, stereophonic sound, Technicolor, and cast of thousands (but only one hero), in which we are producer, director,

script-writer, camera person, sound engineer, stage manager, crew - and the movie critic who reviews the performance next morning! This movie studio also doubles as a movie theatre, in which we can simultaneously watch the show. The only limitation is that, in the movie theatre of the mind, there is only one seat. In order to show your home movies to other people, you have to learn to write, to speak, to play music, to make films. Some of us earn reputations for being good at showing our home movies, using a particular medium, and are thus recognized as artists. However, we are all artists in the sense that we all try, by some means or another, to invite other people in to see our home movies.

I spent four years with J. J. Gibson while a graduate student at Cornell University between 1961 and 1965 and never understood what he was talking about. Yet he was one of the most important influences in my life. He was very excited about something (whatever it was) and I wanted to share this excitement. Ten years later, at that California party, I began to understand what he had been talking about.

Our visual world is built out of this "Mind Movie" which we are running in the magnificent mobile mind studio and viewing in the mind theatre. "Mobile" is a important feature of this studio. Now I understand why J. J. used to chuckle when the tachistoscope arrived in the department and every graduate student suddenly realized that their research required this new tool. It enabled us to fix the subject in a chin-rest staring down a tunnel where we could systematically and accurately present stimuli and measure precisely their response. A person discovers the real world by moving around in it - moving the body with respect to the environment, the head with respect to the body and the eyes with respect to the head. This was his theory [GIBSON J 1966, 1979]. By preventing the subject from moving the body, the head and the eyes, we were able to conduct a very controlled experiment but we could not learn anything about how s/he learned about the real world. It was street-lamp research, named in honor of the drunk who dropped his key in his house and went to look for it under the street-lamp because the light was better there. The light may be better there but it is not where the key is.

The **visual field** (J. J's name for the single frame in this movie - see Figure 7-3) could be very complex, if it contained many people and things, to which the person has multiple cognitive and emotional associations. Some German researchers simplified the visual field by building a **Ganzfeld** (German for whole field) consisting of a six-foot translucent sphere. A subject sitting in the centre of this sphere would have the total retina equally stimulated. Julien Hochberg, another perception theorist at

Cornell University, with typical Yankee ingenuity, built the pocket Ganzfeld by cutting a ping-pong ball in half and placing the two halves over the eyes of the subject. The first step towards making the Ganzfeld more complex was to draw a dot on the sphere or ping-pong ball. The subject recognized this as a figure on a ground. This figure-ground relationship is the basic perceptual experience. When a blind patient has cataracts removed and sees for the first time, this is what he sees. He does not immediately reach up after the bandages are removed and embrace his sweetheart, as in Hollywood movies. He could not distinguish his sweetheart from his doctor or his bedside table. But he knows there is something there.

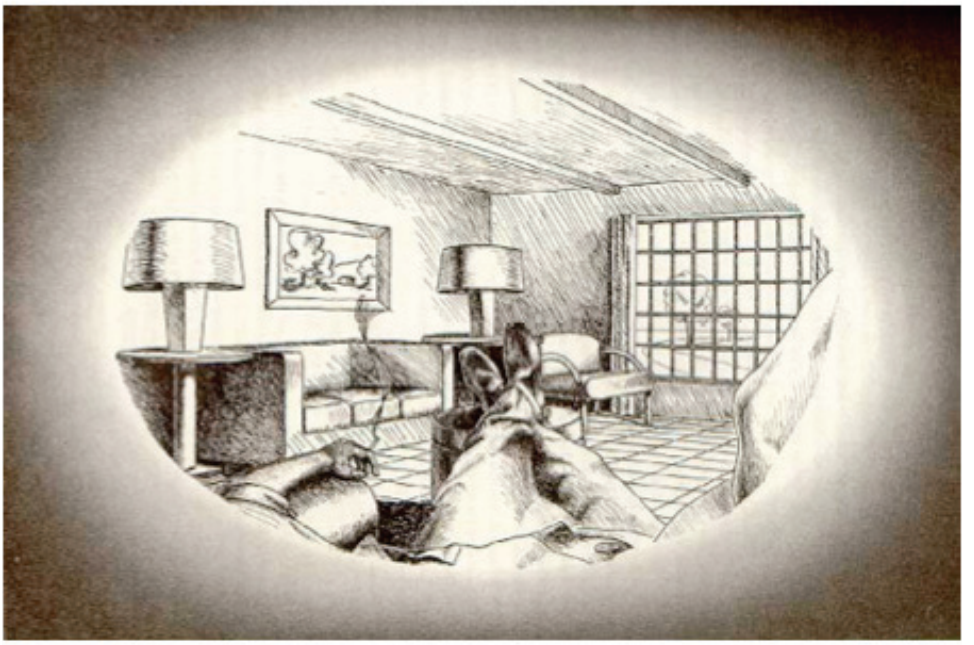

FIGURE 7-3 THE VISUAL FIELD - J. J. GIBSON

This figure-ground perception is so basic that it is impossible not to see any image as a figure on a ground. An image, in which what is figure and what is ground is ambiguous, alternatives between the two. One such **reversible figure** is presented in Figure 7-4. If you stare at the image, you will see it alternating between a young woman and an old woman.

In 1989, Christine Davet, Hal Thwaites, and I organized a conference on Three-dimensional Media Technology. In an opening speech, I said: "*Since this is a conference on the third dimension, we have decided to invite only three-dimensional speakers, hold it (as you can see) in a three-dimensional room, serve drinks in three-dimensional glasses and food on three-dimensional plates*." The point is that the real world, the world we live in, is three dimensional. Look around you - check for yourself - don't take my world for it! We live in a three-dimensional world and the eye is therefore designed to perceive objects in 3D. Adding this third dimension of depth to the current two-dimensional movie is the next logical step toward a more accurate representation of the world-as-we-perceive-it in our everyday experience. The movie metaphor is apt because film is the medium which perhaps, of all the media, best captures the full quality of our personal maps of experience. Indeed, the history of film could be considered as a series of steps towards a closer approximation of the mind movie. Movies added movement to the still image of the photograph, the talkies added sound and color was added to the black-and-white image.

FIGURE 7-4 THE YOUNG-WOMAN/OLD-WOMAN REVERSIBLE FIGURE

There are a number of ways of adding to film technology to bring it closer to the mind movie. One technology is high-definition television (HDTV), which provides improved picture resolution. With HDTV the aspect ratio of the TV screen is closer to that of the eye than with conventional television. The **IMAX** film format comes even closer to our mind movie by removing the artificial frame around the image. The IMAX screen is so large that it fills most of our visual field. The **OMNIMAX** screen, even bigger and curved at the edges, does this even more effectively. Though it does not remove the border, the IMAX/OMNIMAX format allows it to be replaced by the more natural oval border of the eye as it takes a snapshot of the world.[4]

Progression is, of course, not necessarily progress. Many will resist this next step, just as many in the past resisted the introduction of movies, talkies, and color.[5] Many people certainly resist the retroactive introduction of color to films originally shot in black-and-white. Whatever the arguments mustered by critics of colorization (and there are many good ones), the idea that black and white is somehow more natural, is totally unfounded. There is nothing natural about black-and-white unless you are totally color-blind.[6] The same argument applies to two-dimensional images, which are as artificial as black-and-white images. 2-D representations of our 3-D world are cultural artifacts. This is demonstrated by anthropological studies in which people, who have no previous experience of photographs and paintings, have trouble interpreting them.

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[4] Despite all those innovations, the resolution is not as good as our eyes. Julien Winfield, one of my students who helped me with the edutainment section of the CD-ROM to accompany the movie *Rob Roy*, told me the following story. He was working long hours staring at a screen in a beach house in Santa Cruz. As his attention drifted to the view of the Santa Cruz beach in the picture window behind his screen, he was astonished at the great resolution on that "screen". When he started however to try to get his cursor on some passing cloud to edit the image, he realized that it was time to quit.

[5] I once interviewed the famous Director of Photography, Walter Lassalay, on the beach where he had filmed *Zorba the Greek*. He complained that the wide-angle screen was a disastrous innovation for those who considered movies to be about people. We thus need an aspect ratio which is more portrait than landscape. Cinemascope was for making movies about people lying down.

[6] A voice-over on some early black-and-white footage in a documentary on the life of Richard Nixon earnestly informed us that of course, in those days, the world was black-and-white, people did not talk and they moved very quickly.

7.4 OBJECT AND COLOR PERCEPTION

Let us imagine that you arrive late at an afternoon movie. As you move suddenly from the bright illumination outside to the dim illumination inside, you are temporarily blind. After a few minutes you can see relatively well and the invisible legs you stumbled over on your way to your seat are now clearly visible. On getting into your car after the movie, you notice that, in the dim illumination of the evening, your red car is relatively dimmer and the blue car beside it is relatively brighter. You drive to a quiet spot to look at the stars and notice that it is easier to see a dim star by looking at it out of the corner of your eye than by looking at it directly.

It's not as easy to observe the physiological facts. However, if you were able to look *very* closely into the eyes of your date, you would notice that there are short, fat cells concentrated at the centre (**cones**) and long thin cells concentrated at the periphery (**rods**). The rods are composed of a chemical called **iodopsin** which is maximally sensitive to light with a wavelength of 560 millimicrons; the cones are composed of a chemical called **rhodopsin** which is maximally sensitive to a wavelength of 510 millimicrons.

Different structures imply different functions. We do indeed have two visual systems - one involving the cones for bright illumination and the other involving the rods for dim illumination. This is the **duplicity theory**. Diurnal organisms require only the bright illumination system and indeed chickens have only cones; nocturnal organisms require only the dim illumination system and indeed owls have only rods. Since our species roams around day and night, we require both systems. Your temporary blindness in the movie theatre is due to the fact that it takes time to switch from the bright to the dim illumination system. This shift is called **dark adaptation**.[7] The relative dullness of the red car in dim illumination is due to the fact that the rods are more sensitive to the lower end of the spectrum than the cones. The apparently incongruous fact that dim stars

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[7] This shift is not noticed under natural circumstances. Although the falling of night and the breaking of day sound sudden, they are actually gradual, allowing time to switch from one system to the other. The dual system fails to function perfectly only because we have created unnatural situations in which the shift from bright to dim and from dim to bright illumination is sudden.

are easier to see out of the corner of your eye is due to the fact that light is thus focused on the periphery of your retina where the rods are.

If the world were perceived as a black and white movie, then the duplicity theory would be adequate. However, since the world is seen in Technicolor, it is necessary to go beyond the duplicity theory to a supplementary theory. This theory must explain not only the brightness dimension from black to white but the hue dimension of the visual spectrum and the saturation dimension from the most vivid to the most insipid color. The relationship between those three dimensions is summarized in the **color cone**, with brightness as the axis, hue as the circumference, and saturation as the radius (Figure 7-5a). All the myriad colors in our world fall somewhere within this cone. The location of each color can be pinpointed by finding its position on each of those three dimensions.

The best candidate to supplement duplicity theory is the **Young-Helmholtz theory** that the cones are further divided into three types maximally sensitive to blue, green, and red respectively (see Figure 7-5b). By varying light along the wavelength dimension, we generate the corresponding psychological dimension of hue. By varying from light which stimulates only one receptor to light which stimulates all three receptors equally, we generate the corresponding psychological dimension of saturation. By varying from light which provides maximum stimulation to all three receptors to light which provides minimum stimulation of all three receptors, we generate the corresponding psychological dimension of brightness.

7.5 SUBLIMINAL PERCEPTION AND ADVERTISING

At a conference in Baden Baden in 1993, I argued that psychology lost consciousness in the 1920s and didn't regain consciousness until the 1960s. What I didn't point out was that we did not return to the introspection tradition of Wilhelm Wundt, which characterized psychology before its behavioristic interlude, but turned to evolutionary psychology.

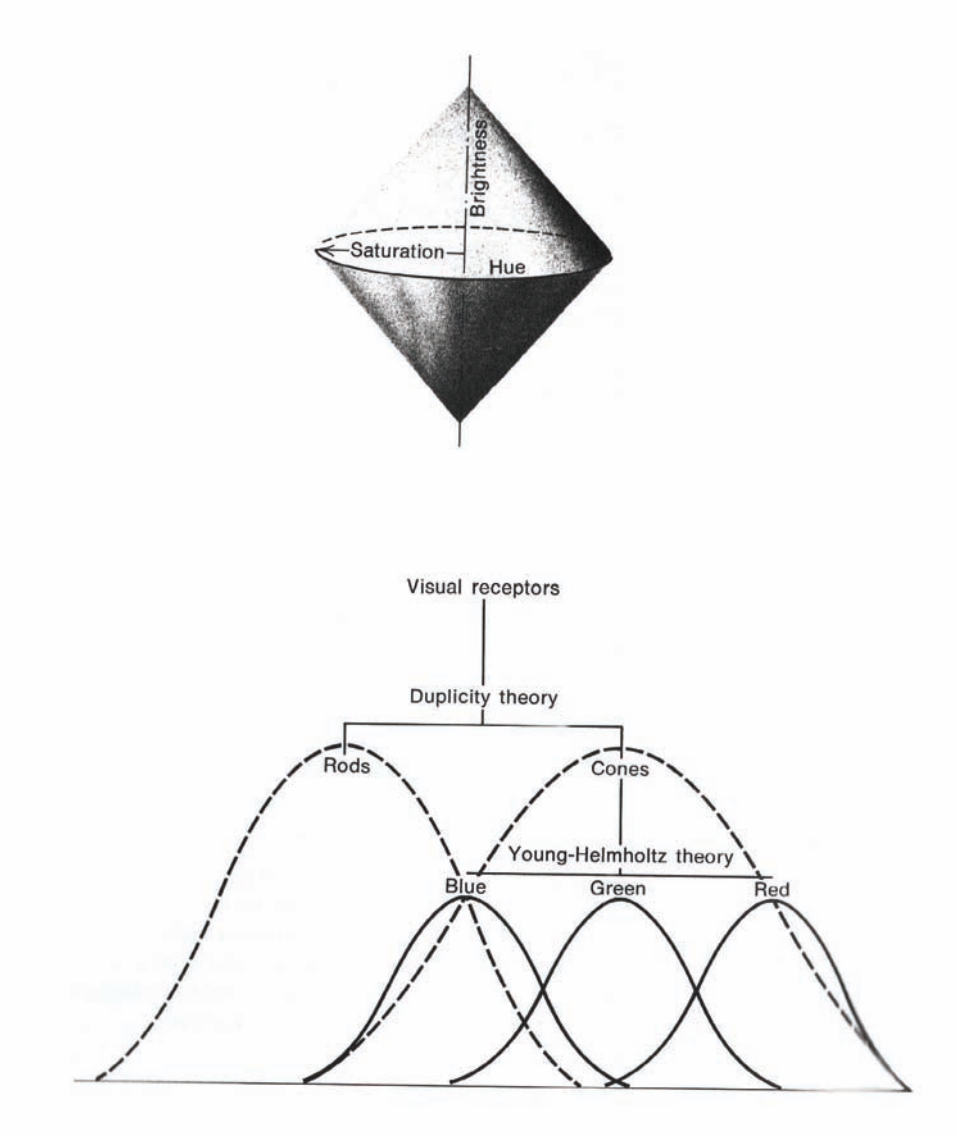

FIGURE 7-5 THREE DIMENSIONS OF LIGHT

Owen Flanagan explains why we have turned to Charles Darwin rather than returned to Wilhelm Wundt. Introspection, the methodology of the pre-behavioristic approach to consciousness, is increasingly suspect. It reveals only the tip of the iceberg. (Of course, our consciousness assures us that this is the most important part because that is all our consciousness knows.) "*Introspection is, at most, a methodological check-and-balance system whose authority can be - and often is - vetoed.*" [FLANAGAN 1991, Page 26].

Darwin helps pin consciousness down in terms of its evolutionary function. In a hunter-gatherer society, we moved a lot to follow scarce food. We had to be quick students of new niches. Consciousness is that function which gives organisms that possess it the ability to adapt quickly to novel states of affairs [FLANAGAN 1991, Page 35]. Flanagan distinguishes between **informational sensitivity** and **experiential sensitivity** and argues that the former far exceeds the latter. He describes a long series of empirical studies, in which subjects are influenced by information of which they are not aware.

Daniel C. Dennett also points to the limited role of consciousness within an evolutionary framework [DENNETT 1991]. In his controversial claim to explain consciousness, he makes the distinction between **auto-phenomenology** (the inside subjective point of view) and **hetero-phenomenology** (the outside objective point of view). The former is unproductive as a means of self-understanding; whereas the latter is productive but no different from the means available to other people. That is, we do not have a privileged information about our own behavior but learn about our own behavior by the same means as other people learn about our behavior. I don't know what I think until I hear what I say or read what I write.

Tor Norretranders makes the same argument in his book *The User Illusion: Cutting Consciousness Down to Size* [NORRETRANDERS]. He bases his case not on either of the above related but "distinct" distinctions, but on an analogy. Before I noticed the subtitle, I assumed this book was about the **user illusion** created by programmers for users of computers. That is, the illusion that, as I work on my Macintosh computer, I am moving documents in and out of files sitting on a desktop and occasionally dropping them into a trash can (which, in an illustration of how analogies sometimes break down, is on my desktop!). Norretranders however is arguing that consciousness is my user interface with the "bio-computer" of my brain. This, like the other, is a useful illusion, but an illusion nevertheless. Underlying what enters my consciousness there is a much vaster domain of which I am not aware.

All three authors point to the implication of this emerging view of consciousness for subliminal perception. Indeed, the literature on subliminal perception indicates that for each sensory modality there is a level of stimulation below which experience fails to occur but in which information about stimuli is received and processed. For example, emotionally threatening words presented below the experiential visual threshold cause changes in auditory sensitivity and vice versa [FLANAGAN 1999, Page

331]. Not only are minds accessible to outsiders; some mental activities are more accessible to outsiders than to the very 'owners' of those minds [DENNETT 1987, Page 162]. Norretranders quotes Dennett and adds: "*Which is disturbing in general and is particularly so in a society where many people's jobs consist of enticing the rest of us to do things we cannot afford to do*." [NORRETRANDERS, Page 165]

7.6 SUBJECTIVE MAP OF OBJECTIVE WORLD

There is considerable controversy within psychology as to whether behavior should be explained in terms of the past (**historical explanation**), the future (**teleological explanation**), or the present (**contemporaneous explanation**). Behaviorists and Freudians prefer historical explanation, humanists prefer teleological explanation, and phenomenologists prefer contemporaneous explanation. Let us look at each in turn.

Watson's little Albert was afraid of rats because he had been conditioned in the past to fear rats. Freud's little Hans was afraid of horses because he had had a traumatic experience in the past involving a horse. We are as we are today, say the behaviorists, because of our conditioning in all our yesterdays. We are as we are today, say the psychoanalysts, because of our traumas in all our yesterdays. Behaviorists and psychoanalysts make strange bedfellows, but the bed of historical explanation they must share. It is a crowded bed, for the vast majority of psychologists have couched their explanations of present behavior and their predictions of future behavior in terms of the past.

Our behavior today, however, is influenced by tomorrow as well as by yesterday. We are pulled by the future as well as pushed by the past. This fact is obvious to the psychologist in his living room and his bedroom but is apparently preposterous to him in his office and his laboratory. His theories and experiments overwhelmingly emphasize the past over the future, and he scolds the few brave theorists who dare to talk in terms of the future with names like "teleologist", "mystic", and other dirty words.

Reasons for the preference for historical over teleological explanation are not hard to find. At first glance, the conception of the future influencing the present would seem to imply that a future event is the cause of a present event as effect. Psychologists, self-conscious in their shiny new lab coats, recoil from what would appear to violate a basic prescription in the dogma of science: thou shalt not put effect before cause. The use of the rat as the prototypic organism is perhaps a second contributory factor. Many a Pied Piper has tried to clear out the rat-infested laboratory by condemning the rat as an inadequate model for human perception and human learning. Such a criticism is even more valid when directed at the rat as a model for human planning. The rat may be short in sight and low in insight, but it is particularly limited in foresight.

Philosophers talked unapologetically about behavior in terms of purposes and goals. Such futuristic terms were some of the proverbial babies behaviorists threw out with the bath water. However, a group of scientists working on the border of psychology and engineering are now beginning to make teleology respectable again. They advocate that we turn for our inspiration from the rat to the thermostat, from the study of the rat in the Skinner box to the study of the Skinner box, from the comparative psychology of man and beast to the comparative psychology of man and machine. They point out that the goal-directed behavior of the thermostat (its goal being to maintain a constant temperature) can be explained in purely mechanical terms. The teleologist can look the mechanist straight in the eye and say "*Consider ye the thermostat, how it works. It intends not; neither does it have purpose. Yet Solomon in all his glory was not so directed as one of these*." He can build a machine that is concrete embodiment of his teleological model and make it work. Many scientists have claimed this as the true mark of understanding. It certainly make one confident of understanding and is a powerful means of silencing critics. Such subjective satisfactions contribute not only to the well-being of the psychologist but to the progress of psychology. No longer timid about investigating the obvious effects of the future on the present, the teleologist has built a more powerful model of the person.

The fear of teleology may partly account for the peculiar neglect by psychologists of the phenomenon of death.[8] This is puzzling, because, whether you believe that "*the aim of life is death*" or "*death is what makes life worth living*," you recognize that death has a profound effect on life.

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[8] Except for Ernest Becker, who earned a Pulitzer Prize with his book, *The Denial of Death*, in which he argued that much of human nature can be attributed to avoiding the inevitable [BECKER].

Writers have demonstrated this point by chronicling the dramatic changes that take place in the behavior of a person who discovers that his death is imminent. The fact that we are aware of our mortality may be one of the important distinctions between us and the other animals.

Could it be that one of the reasons for neglecting death is that the event of death comes after all the events of life and thus death as a causal factor in life would smack of teleology? This consideration of death illuminates the irrationality behind teleophobia - It is not the fact that we die later that influences our lives now but the fact that we know now that we are going to die later. It is not an event in the future that is the cause of our present behavior but some representation of that event within the nervous system at present. Thus teleological explanations are no more mystical than historical explanations, since they both refer simply to present representations within the nervous system of future and past events, respectively. Kurt Lewin makes this brilliantly obvious statement in his **contemporaneity principle**: only present facts can influence present behavior.

When you focus on the objective world (the-world-as-it-is), you see it as stretched out over time, with past, present, and future influences on behavior. However, when you focus on the subjective map of the objective world (the-world-as-you-see-it), as recommended by phenomenologists, you realize that past, present, and future are all embodied in the present. You are not restricted in your subjective map, as you are in your objective world, to be in a particular place at a particular time. You can roam around the world and explore the planets while sitting in your armchair. This morning you can walk along the shore of the Sea of Galilee with Jesus Christ in the year 30, and this afternoon you can talk to HAL in the year 2001. The infinity of space and the eternity of time are potentially here and now. Your behavior can be determined by things not here and not now if they have become part of your subjective map. The present is saturated with the past and pregnant with the future.

CHAPTER 8
FROM FUNCTION TO MALFUNCTION

The poor ego has a still harder time of it; it has to serve three harsh masters, and it has to do its best to reconcile the claims and demands of all three... The three tyrants are the external world, the superego, and the id.

Sigmund Freud
The Anatomy of the Mental Personality

Illusions commend themselves to us because they save us pain and allow us to enjoy pleasure instead. We must therefore accept it without complaint when they sometimes collide with a bit of reality against which they are dashed to pieces.

Sigmund Freud

8.1 FUNCTION THROUGH MALFUNCTION

One approach to the understanding of the function of a system is through its malfunction. That is, you can discover how it should work by observing how it sometimes does not work. This approach may initially appear to be ridiculous. Why observe a malfunctioning system when you might as well observe a functioning system? The logical answer is that a complete description of function should include possible sources of malfunction. But the best answer is probably more psychological than logical. We tend to take functioning systems for granted; it is only when they go wrong that we are motivated to understand them in order to repair them. The little I know about the internal combustion engine I owe to the fact that the ones I have owned tend to break down. The mechanic, in explaining what went wrong and what expensive things he must do to right that wrong, invariably informs me of how the system should work. Malfunction can be explained only in terms of function.

A similar motivation has provided us with considerable information about how the nervous system should function. Psychotherapists, confronted daily with patients whose nervous systems have "*broken down*", are strongly motivated to discover how the nervous system ought to work. The therapist-patient confrontation provides more motivation toward understanding than does the experimenter-subject confrontation, out of which has emerged most of the information presented so far in this book.

Disorders of the nervous system may be either functional or structural. In **structural disorders** the malfunction can be attributed to organic damage to the nervous system, whereas in **functional disorders** no such physical damage can be observed. Since this distinction is never applied to any other subsystem of the organism, a further consideration of it may cast additional light on the special status of the nervous system. This distinction applies only to your nervous system because, as argued in Section 2.2 it is the only system which "*knows*" the environment. A functional disorder can thus be considered as a structural disorder of the person-environment system.

If there is a structure corresponding to every function, then it would seem that there would be a malstructure corresponding to every malfunction. Thus functional disorders would appear to be simply those for which the organic damage has not yet been determined and the term functional merely a confession of ignorance. All that need be decided is which, in a particular disorder, is the precipitating cause. Structuralists point to the many mental aberrations precipitated by syphilis, and functionalists counter with the psychosomatic disorders caused by anxiety. Such effects are not surprising in the light of the intimate structure-function interaction. Indeed, it is surprising that anyone is surprised. Although, in particular cases, malstructure or malfunction may be the precipitating cause, most disorders involve a complex interaction between them. The malstructure-malfunction relationship, like the structure-function relationship, is a chicken-egg problem.

An extension of the analogy with the internal-combustion engine may clarify this distinction. If a car skids on an icy road, it would be futile to look for damage within the engine to explain this malfunction. It is a functional disorder. Unless the car skids into a tree, which damages the engine, this malfunction will not result in malstructure and thus further malfunction. However, since the driver has a memory, the event may persist in his nervous system and cause further malfunction. He may become excessively careful or nervous on icy roads and thus increase the chances of further accidents, or he may irrationally refuse to drive again under any circumstances. Since memory must have some structural basis, it could still be argued that a functional disorder is simply a structural disorder for which the physical damage has not yet been found. However, it is useful to distinguish between a system that is malfunctioning because it has been damaged and a system that is functioning as it should but with inappropriate content.

Consider the strange *Case of the Locomotive God* [LEONARD]. A university professor never left his small midwestern town throughout his lifetime, To do so, he would have had to cross railway tracks, which terrified him. His problem was traced back to an experience as a child in which he had almost got run over by a train. If the train had struck him and damaged his nervous system, then his aberration could be attributed to this structural damage. However, it didn't strike him, it simply scared him. His brain was working perfectly well but with inappropriate content. He had a functional disorder.

Some people tend to think that a functional disorder is less "*real*" or disturbing than a structural disorder. However, a hysteric who

cannot use his hand, even though there is no organic damage, is just as incapacitated as a paralytic whose hand is indeed paralyzed. Indeed, a functional disorder may be even more disturbing. A doctor can tell a patient with tuberculosis precisely what is wrong, point out a dark patch on an X-ray picture, and explain exactly what he must do in order to be cured. A therapist cannot give the same reassurance to a client with neurosis.

The client does not have neurosis in the same sense as the patient has tuberculosis. Just as he does not have experiences but is his experiences, he does not have neurosis but is a neurotic. Since the nervous system is the basis of his personality, a disorder of his nervous system changes his personality. Joe with tuberculosis is still Joe, but Joe with neurosis is someone else. Furthermore, his symptoms interfere with his cure, since they disturb his relationship with his therapist. However, if the therapist can explain (or, rather, if the client can understand) the cause of the neurosis, he need not continue to explain the cure. In neurosis, unlike tuberculosis, understanding is the cure, or, at least, it is the first step towards a cure. Neuroses cannot be explained away, but they can be understood away.

8.2 THE METHOD OF SIGMUND FREUD

The time is 1895 and the place is Vienna. More precisely, the time is 3.00 p.m. on Wednesday, 24 July 1895, and the place is the northeast corner of the terrace of the Bellevue Restaurant in Vienna. A young man sits there engrossed in thought. You may perhaps not recognize him immediately, for his hair has not yet become grayed and his frame has not yet become stooped by a troubled and tempestuous life. As you come closer, however, you may recognize the unmistakable, dark, penetrating eyes of the world's most famous therapist, Sigmund Freud.

The precise time and place are emphasized because this is one of the few cases in the history of science in which the birth of an idea can be so pinpointed. Freud took his biographer, Ernest Jones, to this spot and they chuckled over the possibility of erecting a marble tablet proclaiming *"Here the secret of dreams was revealed to Doctor Sigmund Freud on 24 July 1895"* [JONES, Pages 224-225]. What is that secret? The function of the dream is the fulfillment of a wish. Although we know the exact

point in time and space when this thought first emerged, we can't trace upstream the flow of thoughts which preceded it. We can, however, guess at some of the conditions which created a congenial climate for such a thought.

We know that Freud had just developed at that time his method of **free association** (in which the clients are encouraged to say everything that enters their minds) and had often observed that his clients interspersed accounts of their dreams in their monologues while lying on the now-familiar couch. We know that Freud had previously worked with psychotics and had observed a strong element of wish fulfillment in their hallucinations. We know that Freud was at that time conducting the world's first and only self-psychoanalysis and had observed a tendency to wish fulfillment in his own dreams. We know, in summary, that his insight was based on observation of the spontaneous behavior of people in their everyday lives.

Surprisingly enough, this clinical method may be more objective than the experimental method. The initiative is taken by the patient, whereas in the latter the initiative is taken by the experimenter. Thus the behavior of the patient may be less likely to be influenced by the theoretical biases of the therapist than is the behavior of the subject by the experimenter. Despite rigorous controls to preserve objectivity, an experiment often provides more information about the experimenter than about the subject. Indeed, the very controls the experimenter uses expose his biases. The patient reveals his full personality - "*warts and all*" - but the subject reveals only that limited aspect of himself dictated by the experimental design. There is indeed a source of bias in the sample of clients who present themselves to therapists. However, with the recent humanistic interest in making well people better as well as sick people well, we may be able to reduce this built-in bias by applying this clinical approach to "*normal*" people.

Sigmund Freud celebrated the opening of the 20th century by publishing his book *The Interpretation of Dreams* in the year 1900 [FREUD]. It was the foundation stone for the theory of personality which he continued to develop until his death almost forty years later. He was at first a lonely figure. Not only did he not have any followers - he did not even have any readers. That first book sold only 600 copies in the first 8 years (and, one suspects, that many of those were bought to burn). But he persisted and gradually he built up not only a theory of personality but some support for it.

One of his early supporters was Carl Gustav Jung. He had been asked to review *The Interpretation of Dreams* for the staff members of the Psychiatry Clinic in Zurich where he worked. Impressed, he wrote to Freud, met him, and by 1910 was the first President of the new *International Psychoanalytical Association*. Another early supporter was Alfred Adler. He wrote a letter to his local newspaper, which had published a hostile review of *The Interpretation of Dreams*, defending Freud's ideas. Freud wrote to thank him, invited him to join a small group which met to discuss his theory, and Adler became a charter member of the *Vienna Psychoanalytical Society*. Both Jung and Adler, however, began to introduce deviations from the basic theory of Freud and split off from him to form their own variation on his basic theme - the analytic psychology of Jung and the individual psychology of Adler.

8.3 THE THEORY AND ITS CRITICS

The most famous therapist of all, Sigmund Freud, developed a theory of the person in his attempt to understand the functional disorders of his clients. One reason why his influence is so pervasive is that his theory is not simply a theory of development, of pathology, of motivation, or of dreaming, as are many of the theories with which it is contrasted. It aspires to explain not only each of those limited aspects of human behavior and experience but *all* human behavior and experience. Theorists of development, of pathology, of motivation, of dreaming are like the blind men holding the tusk, trunk, and tail of the elephant and generalizing to the whole elephant. Freud aspires to show the whole elephant. That is, it is not a theory of development, of pathology, of motivation, or of dreaming - it is a theory of personality. Indeed, it was the first theory of personality.

He couched his theory in dramatic terms. The three major characters of his cerebral cast are the lusty, mischievous **Id**, the wise, realistic **Ego**, and the nagging, moralistic **Superego**. Every intelligent layman is by now familiar with many of the magnificent scripts he wrote around those characters - morality plays in which Ego triumphs over the wild Id or the fastidious Superego, tragedies in which Ego is routed by Id or imprisoned by Superego, comedies in which impish Id sneaks its wishes in

disguise past the censor of strait-laced Superego or plays practical jokes on the too-literal Ego.

Freud sees **personality development** as a set of stairs rather than a ramp. Your life energy, or **libido**, is satisfied in turn through various bodily orifices. The horizontal parts of the steps are characterized by the **erogenous zone** through which the libido is currently satisfied, and the vertical parts are characterized by the various little domestic dramas in which the energy is passed on from one orifice to the next. The **oral stage**, in which satisfaction is gained through the mouth, is superseded, through weaning, by the **anal stage**, in which satisfaction is gained through the anus. This stage is in turn superseded, through toilet training, by the **phallic stage**, in which satisfaction is gained through the genitals.

Sexual energy has now arrived where it belongs, but not in the form it must take. The next transition, from the phallic stage to the genital stage, represents a change not in locale of the energy but in its focus. It involves a breathless domestic drama, much more complicated than the two preceding ones, followed by a breathing spell called the **latency period**.

The drama here differs for boys and girls, whereas before the dramas were the same. Since I have never been a little girl, let me consider only the case for the little boy. The stage is set for Oedipus. Enter the heroine - the source of all goodness - the mother. Little Oedipus' sexual energy is thus directed at her. Enter the villain - the mother's lover and hence Oedipus's rival - the father. The **Oedipus Complex** is this love of mother and consequent hate of father. The **castration complex** is a corollary fear that the father will castrate him. To avoid the resultant anxiety, the desire for the mother is repressed. After the subsequent latency period, during which Oedipus identifies with father and decides to settle for a girl just *like* the girl who married dear old Dad, sex again rears its lovely head in the **genital stage**. The libido is, however, now directed toward a less frowned-upon partner, and Oedipus is concerned with Electra's satisfaction as well as his own.

If you are reluctant to accept the Freudian theory of development, your feelings may stem mainly from the fact that you don't remember having passed through those stages and that you are hesitant to ascribe sexual yearnings to the innocent 4-year-old cherubs you know. You don't remember your previous intellectual stages, although Piaget has demonstrated conclusively that they exist. Your resistance to infantile sexuality is caused by a superficial, sentimental view of infancy (who says infants are

good?) and a narrow, distorted view of sex (who says sex is bad?). Convinced? I hope not! I'm certainly not convinced by my own argument. We cannot, however, dismiss the Freudian theory of development from our heads merely because it does not sit well in our stomachs.

Freud documents how this long, complex process of development in our species can go wrong. He explains many aspects of adult personality in terms of failure to pass successfully through the various stages (**fixation**) or in terms of the return to a previous stage (**regression**). Compulsive smokers and loquacious talkers are fixated at the oral stage. The oral character is very dependent, is inclined to peptic ulcers, and is an eternal optimist. The world is one great big nipple. The anal character is obstinate, stingy, and orderly. Male homosexuals are men who have repressed the desire for mother too much and whose repression is thus generalized to all women. Impotents are men who have repressed the desire for mother too little and whose anxiety associated with desire toward her is thus generalized to all women.

This continuous conflict within you creates anxiety. Since anxiety is the worst of all possible states, you develop various strategies, called **defense mechanisms**, to avoid it. You may conveniently forget the thought that arouses anxiety by pushing it down into the unconscious mind. This is **repression**. Since thoughts associated with the original anxiety-arousing thought may also cause anxiety, they, too, may be repressed. Since every thought is somehow associated with every other thought, huge complexes of thoughts may be repressed, resulting possibly in multiple personalities. You may remember the thought but disguise it in various ways. You can justify it as having a more noble motive (**rationalization**); you can attribute it to others (**projection**); you can pretend to the opposite thought (**reaction formation**). Let's illustrate each mechanism with the thought "*I hate X*." (You may substitute for X anyone you like):

Repression	*"X? Who's he?"*
Rationalization	*"Sure, I hate X - but it's nothing personal."*
Projection	*"X hates me."*
Reaction formation	*"I love X"*

All of us use such defense mechanisms. Some of us, however, use them to excess, which leads to neuroses. The various mechanisms

could be classified into two broad strategies for dealing with anxiety: blocking and dodging. Excessive use of blocking strategies leads to **hysteria**. **Anesthesia** is blocking at the stimulus level, **amnesia** is blocking at the central level, and **paralysis** is blocking at the response level. Excessive use of dodging strategies leads to **obsessive-compulsive neuroses**. **Obsession** is dodging by thinking of something else, and **compulsion** is dodging by doing something else. If the anxiety is neither blocked nor dodged, the subject is hit with it. Failure of these two strategies leads to **phobic neuroses**. The internal anxiety is translated into an external fear. This rich language of Freudian terms is summarized in Figure 8-1.

ID
SUPEREGO
EGO

EROGENOUS ZONES
- ORAL STAGE
- ANAL STAGE
- PHALLIC STAGE
- LATENCY PERIOD
- GENITAL STAGE

OEDIPUS COMPLEX
ELECTRA COMPLEX

CASTRATION COMPLEX

FIXATION
REGRESSION

DEFENSE MECHANISMS
REPRESSION
RATIONALIZATION
PROJECTION
REACTION FORMATION

HYSTERIA

DEALING WITH ANXIETY
- ANESTHESIA
- AMNESIA
- PARALYSIS

OBSESSION
COMPULSION

PHOBIA

FIGURE 8-1 SUMMARY OF FREUDIAN TERMS

Freud's early critics tended either to refuse to attend the play or to stomp out during a scene that offended them (although, by couching their criticisms in Freudian terms and anti-Freudian arguments, they revealed that they had at least read the reviews). The major critics were sober scientists who shuddered with horror at his unscientific language. They failed to appreciate, however, that Freud was a trained neurologist who knew as much as anyone of his time about the structure of the nervous system. His dramatic terminology was merely a heuristic device. Who would attend - or attend to - a play about Axon meeting Dendrite at Synapse?

Now that the initial storm has abated, Freud has suffered the fate of many great innovators. He was greeted initially with a sneer and eventually with a yawn. "*What!*" yielded smoothly to "*So what?*". That devious coquette "common sense" rejected his advances indignantly but then, when she eventually succumbed, claimed coyly that she had desired him all along. The preposterous ideas that become obvious are stated without acknowledgement; the preposterous ideas that remain are acknowledged as Freud's and rejected.

One critic said "*There is much that is new and there is much that is true, but what is new is not true and what is true is not new*". Another critic has gone as far as to suggest that Freud's discoveries are analogous to discovering the moon. Actually, he has taken us to the moon and pointed out to us the major characteristics of its landscape. Freud has done for inner space what the space program has done for outer space. And at his own expense.

By translating Freud's theory into a language that is more prosaic though more palatable, we can see more clearly his contribution to our understanding of the function of the nervous system. As argued above in Section 3.1, your nervous system is a subsystem of you as an person, and you as a person are, in turn, a subsystem of a social group. The nervous system has a very special role within this hierarchy of systems within systems. It has three important functions: it "knows" your environment, it mediates between the environment and the other subsystems of you as organism, and it assimilates the principles of your social group. These three functions are performed by the ego, id, and superego, respectively. Thus id, ego, and superego are the biological, psychological, and sociological aspects of you, and the stage on which they meet is your nervous system. In describing how the ego evolves out of the id and how the superego

evolves, in turn, out of the ego, Freud provides a valuable down-to-earthing service by anchoring psychology firmly in biology and by anchoring sociology, in turn, firmly in psychology.

The various topics of cognitive psychology are aspects of the struggle of the ego to obtain and maintain an accurate subjective map of the objective world despite the incessant demands of the id, which chants "*I want*," and the nagging sermons of the superego, which preaches "*Thou shalt not*." The id tries to maximize pleasure, and the ego tries to maximize truth. They come into conflict when pleasure and truth are incompatible ends. We have already met Bernard Berelson and Gary Steiner who described us as a species which can't stand too much reality [BERELSON & STEINER]. It seems that, in the conflict between pleasure and truth, pleasure usually wins.

The superego is concerned with rules (propositions to prescribe our conduct), and the ego is concerned with laws (propositions to describe our environment). Superego and ego come into conflict when rules and laws are incompatible. Studies of conformity demonstrate that, in the conflict between rules and laws, rules usually win. Solomon Asch has demonstrated the incredible power of conformity [ASCH] and Stanley Milgram has demonstrated our remarkable obedience to authority [MILGRAM].

This empirical evidence, then, supports Freud's view that ego usually loses in its conflicts with id and with superego. Thus functional disorders of the nervous system stem from environments in which its various functions are incompatible. The potentiality for functional disorders will always remain - unless we can build a world in which truth is invariably pleasant and rules are invariably rational. Any accuracy of your subjective map of the objective world is a very limited, hard-earned, and precarious accomplishment. Your rationality is a mere tip of a mainly irrational iceberg.

This Freudian framework suggests that the accuracy of your subjective map of the objective world is the criterion of mental health. The neurotic who distorts his subjective map to satisfy his wishes or to placate his conscience fails partially to meet this criterion, and the psychotic whose subjective map has only a tenuous link to the objective world fails totally. The person whose ego has lost the battle with his id is mentally ill, and so also, it is becoming increasingly evident, is the "*good, law-abiding citizen*" whose ego has lost the battle with his superego.

Freud's theory fits congenially within Darwin's theory. It focuses the Darwinian principles directly on the nervous system of our species. Darwin provides our theatre, and Freud provides our stage. Nature loaded Jack and Jill with hunger and thirst so that they can survive as individuals, but she also loaded them with a sex drive so that we can survive as a species. Since nature is concerned more with the survival of the species than with that of the individual, sex is probably an even more powerful drive than hunger or thirst. It is Dame Nature, not Sigmund Freud, who is obsessed with sex. Some would still argue against childhood sexuality on the ground that sex need not rear its lovely head until puberty, when it can perform its procreative function. However, nature requires not only that Jack and Jill merely get together to procreate but that they stay together to care for the resultant child. Nature very ingeniously uses the long period of infant dependency of the parents to build in the caring mechanism so that they will, in turn, care for their children during their period of infant dependency. Freud is more concerned with the development of love than with that of sex.

Freud's **death instinct** (the aim of life is death) would appear to contradict Darwin's theory, in which the aim of life is more life. The death instinct can, however, be interpreted as a poetic way of stating that the nervous system, like all systems, tends toward disorganization. The perpetual battle between the life instincts (both self-preserving and species-preserving) and the death instinct within your nervous system translates simply into the opposing tendencies of anti-entropy and entropy within a system. Our life instincts gain a brief victory by gradually increasing organization throughout a long developmental phase, enable us to spawn other defiant little packages of anti-entropy, and then gradually succumb to the death instinct to increase the probability of their survival.

Konrad Lorenz discovered that, if he arranged to be the first large, moving object a gosling saw during a certain critical period, the gosling would follow him rather than its mother [LORENZ]. The gosling now has a functional disorder, and it would be futile to look for some organic damage to its nervous system. its nervous system is functioning as it was designed to function - but with inappropriate content. Because Lorenz interfered with the bird's normal environment, the biologically sound behavior of following Mother Goose, the source of all goodness, was replaced by the behavior of following Lorenz, which served no function beyond the trivial one of providing amusing pictures for introductory psychology texts. Since nature leaves only a small gap in the genetic program of the goose to be filled in by the environment, there is little danger of its plan going wrong. In the case of our species, however, nature leaves huge gaps

to be filled in by the environment and thus increases the probability that they may be filled in inappropriately. Freud's theory is a dramatic documentation of the many ways in which this long, complex filling-in process can go wrong.

8.4 THE CONTRIBUTION TO PSYCOMM

Although it has become fashionable to dismiss the theory of Sigmund Freud, it is important that we do not throw the baby out with the bath water. He has made some important contributions to the psychology of communication. Let us look, in turn, at three contributions - increased empathy with people who are mentally ill, understanding of the role of communication as both cause and cure of mental illness, and possible explanation of the power of the basic human stories.

Whereas Darwin helps us identify with animals, and Piaget helps us identify with children, Freud helps us identify with people who were often previously dismissed as "*crazy*". The criterion of mental health, implied by the theory of Freud, is, as argued above, an accurate subjective map of the objective world.[1] Since none of us have a perfectly accurate subjective map, we are all, to varying degrees, mentally ill. We all use the various defense mechanisms to varying degrees. Freud tells us that we are all a wee bit crazy. The familiar quip is that neurotics build castles in the sky, psychotics live in them, and therapists collect the rent. We all at least partially furnish our sky castles even though we don't all move in.

Freud also teaches us that communication can be therapeutic. He invented the talking cure, by which patients can contribute to the cure of

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[1] This does not necessarily imply that someone who is mentally healthy lacks imagination. He can take a woman and a fish from his objective world and make a mermaid in his mind, but he recognizes her as his own creation and does not get depressed because he cannot eat her like a fish or love her like a woman.

their own mental illnesses by talking about their lives.[2] A number of more modern therapists have followed up on this insight by further exploring the role of communication in mental illness. They have argued, however, that communication can also be a cause of mental illness.

Gregory Bateson describes a situation in which a person is put in a **double bind** by conflicting communications [BATESON]. A simple example is the command "*be spontaneous*". If a wife, seeking some indication of affection, says to her husband "*I wish you would sometimes bring me flowers*", she has doomed the fulfillment of her wish by stating it. Now, if he doesn't bring her flowers, she is dissatisfied; if he does bring her flowers, she is dissatisfied, because he has not done so spontaneously.

Paul Watzlawick, one of a group of therapists in Palo Alto, elaborates on this theme by presenting a dialog, from the book *Mary Poppins* by Pamela L. Travers, between Mrs Corry, a small, witch-like old woman and her two large, sad daughters, Fannie and Annie [WATZLAWICK, Pages 16-17]:

"*I suppose, my dear*" - she turned to Mary Poppins whom she appeared to know very well - "*I suppose you have come for some gingerbread?*"
"*That's right, Mrs Corry*", says Mary Poppins politely.
"*Good. Have Fannie and Annie given you any?*"
"*No, mother*," said Miss Fannie meekly.
"*We were just going to, mother--*" began Miss Annie in a frightened whisper.
At that, Mrs Corry drew herself up to her full height and regarded her gigantic daughters furiously. Then she said in a soft, fierce, terrifying voice:
"*Just going to? Oh, indeed. That is very interesting. And who, may I ask, Annie, gave you permission to give away my gingerbread--?*"
"*Nobody, Mother. And I didn't give it away. I only thought--*"

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[2] I once attended a seminar by a psychologist who argued that Freud's talking cure could be augmented by his writing cure. In one of his exercises he invited us to write a dialogue with a wise old man. I chose to write a dialogue with an uncle I lived with for a couple of years as a child. To my surprise, I found that, in my part of the dialogue, I was writing cursive. I hadn't written cursive for 40 years – I had printed and typed my way through High School and university. I told this story to my uncle on visiting him after his 100th birthday. He said that I had learned to write when living with him. When I asked *Why then did I not write for 40 years?,* he answered *You repressed it because I left you – don't you know Freud?* The repression had been so effective that, despite getting a Ph. D. in Psychology and teaching it for many years, I couldn't see what was clear to a 100-year-old man who never went to High School!

"*You only thought! That is very kind of you. But I will thank you not to think. I can do all the thinking that's necessary here!*" said Mrs. Corry in her soft, terrifying voice. Then she burst into a harsh cackle of laughter. "*Look at her! Just look at her! Cowardy-custard! Crybaby!*" she shrieked, pointing her knotty finger at her daughter (who is now crying).

Mrs. Corry has managed to block poor Annie in all three areas of human functioning: acting, thinking, and feeling.

This damned-if-you-do and damned-if-you-don't situation makes an interesting illustration for an argument or an amusing anecdote in a novel. However, it can be tragic if a child is trapped in this situation within that intimate little society of the family. R. D. Laing, a Scottish psychotherapist, has argued that schizophrenia can be caused by such a double bind [LAING & ESTERSON]. He practiced family therapy, in which he treated the whole family, since this was a disorder of the whole family situation rather than of the child trapped in that situation. The child is not insane but caught in an insane setting.

His argument has been subsequently down-played since some biological basis of schizophrenia has been discovered which is treatable with drugs. Perhaps however, the pendulum has swung too far in the opposite direction, since the biological, as opposed to the sociological argument, relieves parents of guilt and therapists of debilitating work. It is much easier to dispense pills than to interact intimately with demanding and frustrating people.

R. D. Laing himself went on to describe the complex interpersonal knots we get tied up in through meta-communication and miscommunication. For example [LAING 1970, Page 5]:

He does not think there is anything the matter with him
because
one of the things that is
the matter with him
is that he does not think there is anything
the matter with him
Therefore
We have to help him realize that, the fact that he does not think there is anything
the matter with him
is one of the things that is
the matter with him

Placing schizophrenics in mental hospitals often only allows them to escape the frying-pan of the family setting into the fire of the hospital setting. David Rosenhan arranged to have sane people admitted to the insane setting of a mental hospital [ROSENHAN]. They were in another double bind. They were all admitted, diagnosed as schizophrenic, based on their statement that they heard voices in their heads. Though acting sane during their hospitalization, they took an average of 19 days (range from 7 to 52) to get out again as "*schizophrenics in remission*". Ironically, whereas none of the staff recognized them as fake, many of the real mental patients did.

It was argued above that functional disorders were disorders of the person-environment system. Treatment must focus on the whole system. In those cases of a child in a dysfunctional family or a patient in a mental hospital, the problem lies largely in the environment. There are insane people but there are also sane people in insane situations. Whereas good communication can cure mental illness, poor communication can cause mental illness.

In the Triad Model - see Figure 3-1 - the person is considered as the triple overlap of the natural world (ecosphere), the social world (sociosphere), and the person-made world (technosphere). Stories require drama which requires conflict. Thus, this model suggests a classification of stories into four categories - conflict between the person and the ecosphere (e.g. Moby Dick), conflict between the person and the sociosphere (e.g. The Scarlet Letter), conflict between the person and the technosphere (e.g. Frankenstein), and conflict within the person (e.g. Dr. Jekyll and Mr. Hyde).

Id, superego, ego could be identified respectively with the three spheres of this Triad Model. Those classic stories focus on those conflicts described by Freud. One insight from Freud is that those great themes of literature may owe their lasting appeal to the fact that they reflect dramas occurring within our own nervous systems. Freud wrote the original script for those stories, and Freudians have since added variations to it. Adler preferred the themes of Horatio Alger and Jung those of Herman Hesse. Reich cast Id as hero, and Sullivan preferred Superego in this role.

My students challenged me to fit "*The Matrix Trilogy*" within this framework. I had to add a second-story to my model, representing the subjective map of the objective world within the person in the centre. Thus, the Matrix fitted (with *Alice in Wonderland* and *The Wizard of Oz,* to

which there are frequent references in the Matrix movies) in another story - the conflict between the objective world and the subjective map. You fall down a rabbit hole or click your heels three times or are immersed in a virtual reality and find yourself in a world where your map does not fit.[3] Freud anticipated me here too, since an ill-fitting map of the world is the general situation of the neurotic.
The five stories are represented in Figure 8-2.

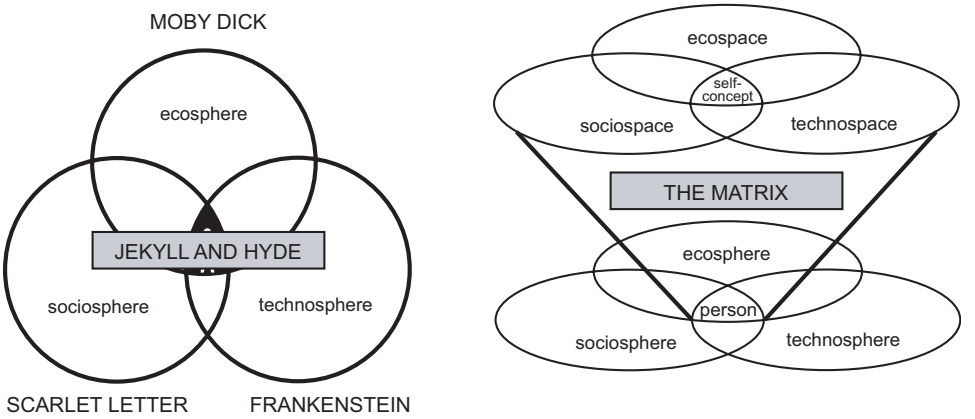

FIGURE 8-2 THE FIVE BASIC STORIES?

Henry Gleitman, one of my mentors in graduate school, gave two three-hour lectures on Freud in the evening independent of his brilliant introductory course in psychology during the day. He concluded the Freud lectures by asking the following three questions:
I*f you wanted your ceiling painted, would you hire Leonardo da Vinci or an average graduate of an art school today?* The class chose Leonardo.
If you had a medical problem, would you choose Hippocrates the father of medicine or an average graduate of a medical school today? The class chose the mediocre graduate.
If you had a psychological problem, would you go to Freud or an average graduate of a school of psychoanalysis today? The class chose Freud.
Ah, said Gleitman, *you placed Freud with Leonardo rather than Hippocrates, with the artist rather than the scientist. That is why I do not include Freud in a course in the science of psychology.*

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[3] The Harry Potter stories are more recent examples of this category. When you get on that train at platform 9 3/4 in King's Cross Station, your destination is a world dramatically different from the muggle world you have left.

However, I choose to include him in a book on the psychology of communication, since psycomm is both science and art. We may not be able to stand on the shoulders of an artist and see further as we can in the case of a scientist. However, we can benefit from the insights into the psychology of communication provided by Sigmund Freud.

CHAPTER 9
SIMULATION AND AI

9.1 LOGIC OF APPROACH

9.2 HISTORY OF APPROACH

9.3 CRITIQUE OF APPROACH

9.4 APPLICATION OF APPROACH

The main lesson of thirty-five years of AI research is that the hard problems are easy and the easy problems are hard. The mental abilities of a four-year-old that we take for granted – recognizing a face, lifting a pencil, walking across a room, answering a question – in fact solve some of the hardest engineering problems ever conceived.... As the new generation of intelligent devices appears, it will be the stock analysts and petrochemical engineers and parole board members who are in danger of being replaced by machines. The gardeners, receptionists, and cooks are secure in their jobs for decades to come.

Steven Pinker

9.1 LOGIC OF APPROACH

In Chapter 4, Miller, Galanter and Pribram developed their TOTE unit by using the analogy of the nervous system and the computer. Since then, we have considered ontogenetic development - from child to adult (Chapter 5) and phylogenetic development - from animal to human (Chapter 6) to place the study of the nervous system firmly within biology where it belongs. We are organisms not mechanisms. Biology is not rocket science. Rocket science is easy. Biology is the study of complex systems whereas physics is the study of simple systems.

Two complexities of the nervous system have been considered. In Chapter 7, we explored the implications of the fact that the nervous system can be viewed from the inside (experience) as well as from the outside (behavior). In Chapter 8, we explored the implications of the fact that the nervous system has functional as well as structural disorders. That is, since the nervous system "knows" the environment, there can be disorders of the person-environment system as well as disorders of the person.

Because of such complexities unique to the nervous system, it is tempting to return to the strategy in Chapter 4. That is, to approach the nervous system indirectly by looking at simpler systems and try to gain some insight into it by analogy. One of the reasons that mechanisms are simpler than organisms is that we have built them ourselves, whereas we have been created by nature over hundreds of thousands of years. We could perhaps gain some insight into ourselves by building mechanisms which simulate our functions. This simulation approach - the domain of **artificial intelligence (AI)** - is the focus of this chapter.

My first introduction to artificial intelligence was a talk by Frank Rosenblatt at Cornell University while I was a graduate student. He had built a **Perceptron** to simulate the human visual system [ROSENBLATT]. It consisted of a board (representing the retina of the eye) wired up to another board (representing the reception area for vision in the occipital lobe of the brain). The system was wired up randomly (which apparently upset his students in electronic engineering who had been taught to wire systems up very carefully). The system was then "taught" the difference between the letters E and F. It was "rewarded" for a correct response by reducing the resistance in the wires which fired; it was "punished" for a wrong response

by increasing the resistance in the wires that fired. Thus the probability of making the correct response was increased and of making the wrong response decreased, just as the probability of responses of Thorndike's cats were increased and decreased. Eventually, the system could distinguish between the letters E and F regardless of their size, orientation and position on the screen. The learning curve of this mechanism was similar to that of an organism and supported the argument that the visual system is initially wired up randomly and hard-wired by learning.

I remember leaving that lecture wondering why he had devoted a decade of study and thousands of dollars to build a machine which could distinguish E and F. I had been created by two people who never went to High School in one delightful moment and I could do much more than distinguish between E and F. Artificial intelligence, like military intelligence and smart bomb, sounded to me like an oxymoron. However, I subsequently learned to understand the logic of this simulation approach and to share the dream of the artificial intelligentsia that we could eventually simulate ourselves. Indeed, I once built a graduate course entitled *Artificial Intelligence and Natural Communication*. The best test of understanding of a system is that you can build that system. Build it and you will understand.

9.2 HISTORY OF APPROACH

We must imagine something before we create it. Every invention appears first in the subjective map of someone before it appears in our common objective world. The machine, like the person, must be conceived before it is born. The automation of thought by means of computers emerged from imagining a simulation of ourselves. This section of our story began then with two teen-age girls.[1]

Mary Wollstonecraft Goodwin (1797-1851), while still a teenager, had run off to Europe with two poets - Percy Bysshe Shelley and George Gordon, the notorious Lord Byron. They were holed up in a villa in Switzerland during a very rainy summer. To entertain them-

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[1] Up till now, I have been focusing, to my embarrassment, on the work of dead white males.

selves, they decided to write horror stories. The two poets, being experienced writers, started writing right away, and taunted Mary who could not even get started. One night, however, she had a dream and started writing a story the next morning, which quickly evolved into the familiar famous story of *Frankenstein* [SHELLEY].

Meanwhile, back in England, Ada Augusta Byron (1815-1851), the daughter of Lord Byron, upset that her father had deserted her when she was only one month old, turned from art to science. She attended a demonstration by an eccentric inventor called Charles Babbage (1791-1871) of his Difference Engine. Although only 17, she recognized its importance right away. Babbage had invented the computer. Ada Byron (later, Lady Lovelace) worked with Charles Babbage for the rest of her life [RHEINGOLD 1985].

He worked on the hardware and she worked on the software. Alas, Babbage never could get his machine to work. However, if he had, the software written by Ada *would* have worked. She had discovered all the major basic principles of programming. "Ada" is now the name of a computer language named in her honor as the world's first programmer. The two major cyberpunk authors - William Gibson and Bruce Sterling - surprised their fans by getting together to write a Victorian novel. *The Difference Engine* was an alternative history which explores the repercussions on society if Babbage had been able to get his machine to work over 100 years before someone else finally managed to build one that did work [GIBSON W & STERLING B].

Another eccentric Englishman contributed to our conceptualization of the computer. Alan Turing (1912-1954) presented us with the **Turing Machine** and the **Turing Test**. He imagined a device through which one could thread an infinite loop of squares [TURING]. Each square contains either a 1 or a 0. The machine can either change one symbol to the other or leave it the same. He argued that any problem which can be expressed clearly in terms of logical statements could be solved by this machine. The Turing Test involved communication between a person with a terminal linked to two other terminals which are out of sight, operated respectively

by a person and by a machine. If the person could not tell which was which, the machine had passed the Turing Test.[2]

Alan Turing put his theory into practice during World War 2. He was invited to join a group which was attempting to break the code of a machine used by the Nazis to transmit coded messages. Turing reverse-engineered the Enigma machine which created the code, from a description of the machine given him by a disgruntled former employee of the Nazis who had been dismissed because he was Jewish. As a result, the Allied Forces were able to read captured Nazi messages throughout most of the war. Many have argued that Alan Turing did more to win that war than anyone else including Winston Churchill who considered the breaking of the code so valuable that he did not warn people about a bombing raid for fear of alerting the Nazis that their code had been broken.

One of Turing's eccentricities was that he was an outed homosexual at a time and place where this was dangerous. (This homophobic society had jailed one of our greatest playwrights, Oscar Wilde, essentially for homosexuality at the height of his fame only a few decades earlier.) Dismissed from his job and abandoned by those who could have saved him because his contribution was still classified information, he committed suicide by biting into an apple laced with cyanide.[3]

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[2] This means, of course, that the computer would sometimes have to act stupid in order to appear human. If given two 6-digit numbers to multiply, it would have to "pretend" to take some time. An instant answer, which it could provide, would be suspect.

[3] This apple deserves a place alongside Newton's in the annals of famous apples in science. Turing's work was just de-classified in the 1970s. Since then, his story has been told in a number of media - for example, a cyberpunk novel, *Cryptonomicon*, by the current star within this genre [STEPHENSON 1999], a documentary, *Breaking the Code*, starring Derek Jacobi as Alan Turing; and a film, *U-571*, about the capture of Enigma from a German submarine (with Americans replacing the British who "starred" in the real story, since it's an American movie). Robert Harris has written a book based on the work of Turing and his colleagues. The book, entitled *Enigma*, is in turn the basis for a movie under the same title.

As Turing realized, the best code for a computer consists of two letters - 0 and 1.[4] Thus computer technology - no matter how esoteric it may seem - is simpler than 1, 2, 3. It's 0, 1. A computer can thus be created using any device which can toggle between two stable states, representing 0 and 1. In the first generation, the device was a vacuum tube; in the second, it was a transistor; in the third, it was an integrated circuit; in the fourth, it was a microprocessor (many integrated circuits on a single chip). Each of those devices supplanted the previous device, in contrast to the generations of media, in which each generation simply supplemented the previous generations.

We are currently awaiting the fifth generation. Perhaps it will be a chip made of gallium arsenide rather than silicon, which gets too hot at the current speed of operation. Perhaps it will be a biochip, made of organic rather than mechanical material. Whatever it will be, the saga of the incredible shrinking chip will continue. Computers are getting smaller and smaller, faster and faster, cheaper and cheaper, smarter and smarter, and friendlier and friendlier. **Moore's Law**, that the speed of a chip will double and the cost of a chip will half every 18 months, has applied over the last few decades of the 20th century and is continuing in the 21st century.

The computer had a long gestation period. Though conceived by Charles Babbage in the early 19th century, it was not born until over a century later. However, once born, it grew (or shrunk?) rapidly. Indeed, so rapidly that its history can be described within a single life-time - for example, mine.

1955 My first steady job after getting off the boat from Scotland was as a clerk in the Canadian Pacific Railway's offices at Windsor Station. CPR had just got its first computer [SPANNER]. It filled a huge, air-conditioned room, cost millions of dollars, had a score of priest-engineers attending to it, and all we clerks were terrified that it was going to take

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[4] It may initially appear surprising that such a powerful language can be created using only two letters. Speech - the language of the first generation - consists of 44 units (the phonemes), and print - the language of the second generation - consists of 26 units (the graphemes - i.e. the letters of the alphabet). However, the "language" in which you and I are written - the genetic code - consists of only 4 letters - A (Adenine), G (Guanine), C (Cytosine), and T (Thymine). The complexity of a system is thus not directly correlated with the number of elements it contains.

over our jobs. This was, of course, only seven years after the first working computer was built at the University of Pennsylvania in 1948.[5]

1969 A group of West Indian students, protesting what they perceived as racism, took over my classroom H-110 in the Hall Building of Sir George Williams University and then moved, along with many of my students, to occupy the Computer Centre upstairs. This site was chosen because the computer was viewed as the tool of the oppressive "*System*" (the military-industrial-academic complex) which was violating human rights. The computer was still a massive device which had to be fed a stack of cards to be processed by the engineers who returned results days later. "*Do not bend, staple, or mutilate*" was one of the slogans of the protesters, who threw the cards out of the windows when the police stormed the Computer Centre.

1984 Fifteen years later, I buy my first computer - the 128K Macintosh. Though its power and price ($3000) is laughable now, it had more power than that first computer at CPR and sat on my desktop.[6] The big step however was not the next installment in the saga of the incredible shrinking chip but the improvement in the interface. It was like improving your axe by getting a new handle rather than a new head. There was no essential difference in the inside of the computer (I opened it up to check and found that it was mostly empty) but in the relationship between the computer and myself - the **user interface**. This **WIMP** (Window-Icon-Mouse-Pulldown menu) **interface** replaced the previous **MACHO interface** (see Figure 9-1) and reduced our dependence on the high priests attending to the computer. It was user friendly so that we could use it (us) or idiot proof so that we could not misuse it (engineers).

2004 My computer is now powerful enough to enable me to make a silicon clone (siliclone) of myself, which has since grown to include 6

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[5] Actually the release of the classified information about the work of Alan Turing and his colleagues in deciphering Nazi codes during World War 2 reveals that this group had built a computer earlier.

Thanks to my neighbor, Ron Ritchie, of the Canadian Pacific Railway, for finding those sources for me.

[6] On a recent visit to a Macintosh computer store, I noticed that they were using two of them as bookends.

books (including this one), 4 chapters in books, 5 articles, 7 reviews, and 9 talks. This reduction in the size and cost of computing raises the hopes of the artificial intelligentsia once again. The prospect of the singularity when our creations will outsmart us and perhaps condescend to keep us as pets is being presented anew [KURZWEIL].

FIGURE 9-1 WIMP VS MACHO INTERFACE

9.3 CRITIQUE OF APPROACH

Simulating the structure of the person is easy. Any one who has been to Madame Tussaud's wax museum knows this. More recently, holography has been used to simulate people. Bill Kuhns rushed home to write a book about "*media blur*" after finding himself trying to buy a ticket from a holographic person at the entrance to the Holography Museum in New York [KUHNS]. He was concerned that we are getting so good at representing reality that people will have more and more difficulty in determining what is real and what is mediated. You can now go to www.realdolls.com[7] and order a customized life-sized doll which, once unwrapped from the plain brown box in which it is delivered, is convincingly like a real person.

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[7] The "real girl" in the movie *Lars and the Real Girl* was ordered from this site.

It is more difficult to create a simulation of a person which acts. However, any one who has ever taken the *Pirates of the Caribbean* ride at Disneyland (recently expanded into movies) knows that such life-like representations of people can be very convincingly animated. That is, if it is required only to follow a very limited script: Lean over bridge, wave right arm, say "*Yo He Ho!*" More recent simulations of people have appeared on computer, television, and movie screens. They have become progressively more and more life-like as computer technology has improved - Max Headroom, Antonova, Kyoko Date, Dr. Avi Ross in *Final Fantasy*. William Gibson wrote a book entitled *Idoru* about an American going to Japan to meet a pop singer he assumed was real since he had seen her on television, had listened to her entire discography, and had read her biography [GIBSON W 1996]. She had been created electronically. Before the book was published, this had already happened as a result of the creation of the digital character Kyoko Date. Fact is faster than fiction. Dr. Ross is so realistic that it is difficult to believe that she is merely pixels in motion (see Figure 9-2).

One of my former students (known on-line as *The Digital Diva* till she sold the name to Microsoft - when are they going to make an offer for "siliclone"?), while working at the Digital Renaissance studio which did the special effects for the movie *Titanic* told me that they were having difficulty simulating hair. That's why the two major animated movies at that time - *A Bug's Life* and *Antz* - starred ants. Now that computer programmers have leapt over that final hurdle, the prospect opens up of replacing high-paid real actors with simulated actors. The humorous ramifications of such a move is the theme pursued in the movie *Simone* (SIMulation ONE).

The simulation of function is much more difficult than the simulation of structure. The reverse engineering of the Enigma machine by Alan Turing was an incredible feat. However, reverse engineering organisms is much more difficult. Enigma was a machine made by a person and thus potentially understandable to another person. You are an organism created by nature over hundreds of thousands of years. Some functions are more difficult to simulate than others. Here the artificial intelligentsia has had some surprises. What would seem difficult for us is easy to simulate and what would seem easy to us is difficult to simulate. For example, playing chess has been simulated so well that a computer program called Big Blue beat the world champion. Yet we have not been able to simulate going into a restaurant and ordering a meal. Common sense is not so common in the simulated world.

FIGURE 9-2 VARIOUS SIMULATIONS

Communicating - the focus of this book - is surprisingly easy. Joseph Weizenbaum did it by accident [WEIZENBAUM]. He created a program called Eliza which simulated the conversation of a non-directive therapist as a spoof of his rivals in the artificial intelligence community. The program would pick up on certain words uttered by the "client" and embed them in a rhetorical question. Thus, if the client mentioned his/her mother, Eliza would reply "*Tell me more about your mother.*" One day Weizenbaum found his secretary deeply into a conversation with Eliza. Subsequently, many people had cheap therapeutic sessions with Eliza,

many of them claiming her better than "real" therapists. Poetry written by programs has also challenged the Turing Test. The automated voice which responds to a 411 call is quite convincing as long as you don't have an accent and ask clearly for the person or business you want to call.

The artificial intelligentsia have been more successful in gaining control rather than gaining understanding. That is, they have been more successful as engineers than as scientists. They have created robots which simulate human functions without any effort expanded to simulate their structures. The robot which is now roaming Mars can simulate many of our functions - moving over surfaces, digging up soil samples, taking photographs, etc. However, it does not look at all like us. However, it can do things which we can't (yet) do. Such robots are very valuable in replacing us in dangerous (dismantling bombs) and inaccessible places (exploring Mars and the Titanic). However, they do not contribute to understanding of ourselves. They are action rather than thought figures [BROOKS].

Some robots however must simulate structure as well as function. Robots designed as servants (e.g. Asimo) and as pets (e.g. Aibo) gain credibility by looking like what they represent as well as acting like them. Thus, the robot servants and pets look like people and animals. This introduces difficulties beyond those involved in creating systems to do dangerous and distant tasks. It's easy to create a household robot which runs on wheels but not one which "walks". This series of balancing and unbalancing acts is difficult to simulate. Walking upstairs creates another whole new dimension.

The engineering approach focuses appropriately on efficiency. However, in some situations, efficiency is not the appropriate criterion. We would laugh if someone said Schumann would have been more efficient if he didn't repeat the same notes with different instruments and didn't leave spaces between the notes and could thus have finished his "*Unfinished Symphony*". If someone impressed by Roger Bannister's four-minute mile, aspired to the four-minute -- er, love session, we would laugh too. In both those cases, the criterion is not efficiency but conviviality. When it comes to listening to beautiful music and making love to a beautiful woman, the less efficient, the longer it takes the better. Efficiency may be a criterion for means but not for ends. Human acts which have become functionally autonomous - they have become ends in themselves rather than means to ends - have another criterion of conviviality.

Some people consider that automation is the down-side of simulation. That is, machines, which can perform human functions, will replace

humans. Others would argue that anyone who could be replaced by a machine should be replaced by a machine. People should not be doing mechanical things. In our imperfect world, however, machines have taken many jobs previously done by people. Which jobs? Arthur Cordell suggested that automation is driving a wedge between high-level jobs which can't be automated for technical reasons and low-level jobs which won't be automated for economic reasons. He called it the Boeing Effect, since there are high-level jobs in the cockpit, low-level jobs in the body of the plane and nothing in between. Ironically, it is the high-level jobs that are easier to automate. Large planes are flown by computers. The pilot is there just to over-ride the computer if something goes wrong. and to reassure the passengers that someONE is in charge and not someTHING. Meanwhile, back in the body, the stewardess can not be replaced as easily. A robot rolling down the aisle, chirping "*coffee, tea, or me?*" would not reassure an old lady who is taking her first flight.

Such "low-level jobs" require empathy which the machine can never have. I have retained the sexist male pilot and female stewardess to make a point. The high-prestige, high-pay jobs typically go to men and the low-prestige, low-pay jobs typically go to women. However, one by-product of the simulation approach is that the more "human" jobs, which are dominated by women, should be the best-paid and the most prestigious. The doctor can easily be replaced by a machine. Diagnostic programs are way better than doctors. However, there are no equivalent programs for the caring profession of the nurse.

9.4 APPLICATION OF APPROACH

Simulation may better serve as simulation of environments than of persons. Pilots of large planes can not be trained on the planes. With the huge cost of fuel, it would not be economically feasible to fly those planes around empty as they learned to fly. Not to mention the high cost of their mistakes. They learn to fly in flight simulators which simulate the experience of flying those large planes. No fuel is required and, if they make an error, they just hit the reset button. Those flight simulators are so realistic that the first time a person trained on them is in the cockpit of a "real" plane, s/he is co-pilot responsible for a plane-load of passengers.

In the early days of medicine, doctors were tempted to steal corpses from cemeteries to train their students. Now medical students can be trained on virtual cadavers. Once again, one need only press the reset button after an error.

With the dramatic reduction in the cost of computer memory, will it be possible to extend this simulation approach to teaching in other disciplines? One discipline ripe for improvement in teaching is history. In their book, *1066 and All That*, two authors whimsically described the limited and distorted view of history as a result of the rote learning of names and dates [SELLAR & YEATMAN]. A collection of student bloopers, collected by history teachers, makes the same point (see Figure 9-3).

When assigned to create the edutainment section of a CD-ROM to accompany the movie *Rob Roy*, I imagined a user dialing a time and place and finding out what is happening then and there. Thus, if they dialed Inverness in 1746, they would see a re-enactment of the Battle of Culloden. They could choose to follow Bonnie Prince Charlie on his flight to the West of Scotland and then to France. Or he could wait around until 1773 and join Samuel Johnson on his tour of the Scottish Highlands with his Scottish biographer, James Boswell, or dial back to 1562 to meet Mary, Queen of Scots on her visit to Inverness shortly after her return from France. There was not enough time or space for such a grand project so we had to settle for flying around the Trossachs where Rob Roy lived and clicking on icons which emerged through the mist.

I'm now considering a much more modest project - created a virtual version of my town of Hudson. A first step was to create a wee book - *Main Road, Hudson: Then and Now* - which enable the reader to "walk" along the Main Road, "stop" at the houses of historical interest, look at an old and new photo of the house, and read a little of its associated history. In the electronic version, it would be possible to have the information in the archives of the Hudson Historical Society, linked to the relevant building. Fire hydrants found along the Main Road could be "parked" in front of each building to indicate what kinds of information it contained. Thus, for example, *Greenwood Centre for Living History* could contain interior shots of itself, Hudson Gazette office could contain clippings of articles about history, the train station which is converted into Hudson Village Theatre could contain audio and/or video clippings of performances by local artists, and the Town Hall could contain the genealogical records of local families.

The inhabitants of Egypt were called mummies. they lived in the Sarah Dessert and traveled by Camelot. The climate of the Sarah is such that the inhabitants have to live elsewhere, so certain areas of the dessert are cultivated by irritation. The Egyptians built the Pyramids in the shape of a huge triangular cube. The Pramids are a range of mountains between France and Spain.

Homer also wrote the "Oddity", in which Penelope was the last hardship that Ulysses endured on his journey. Actually, Homer was not written by Homer but by another man of that name.

Socrates was a famous Greek teacher who went around giving people advice. They killed him. Socrates died from an overdose of wedlock. In the Olympic Games, Greeks ran races, jumped, hurled the biscuits, and threw the java. The reward to the victor was a coral wreath. The government of Athens was democratic because the people took the law into their own hands. There were no wars in Greece, as the mountains were so high that they couldn't climb over to see what their neighbors were doing. When they fought the Parisians, the Greeks were outnumbered because the Persians had more men.

The government of England was a limited mockery. Henry VIII found walking difficult because he had an abbess on his knee. Queen Elizabeth exposed herself before her troops, they all shouted "hurrah." Then her navy went out and defeated the Spanish Armadillo.

The sun never set on the British Empire because the british Empire is in the East and the sun sets in the West. Queen Victoria was the longest queen. She sat on a thorn for 63 years. her reclining years and finally the end of her life were exemplatory of a great personality. Her death was the final event which ended her reign.

FIGURE 9-3 STUDENT BLOOPERS

CHAPTER 10
MEDIATION AND IA

10.1 EXTENSION OF NERVOUS SYSTEM

10.2 TORONTO SCHOOL OF MEDIA STUDIES

10.3 WHAT KIND OF CYBORG DO YOU PLAN TO BE?

All I can do is assure you that the cyborg is not to be found in the realm of hypothetical eventualities and hyperbolic horrors -- it is real; it is now. Each scenario in this book encounters wearable technology; each scenario postulates a new interface, a new relationship, between the human being and technology; each scenario demonstrates how present day extensions of human ability through technology affect the shape of society; and each scenario speaks to the way we live our lives now, as opposed to the way we can expect to live our lives in some potentially disastrous future.

Steve Mann with Hal Niedzviecki, **Cyborg**, Page xi

I was born human.
This was merely due to the hand of fate, acting at a particular place and time. But while fate made me human, it also gave me the power to do something about it. The ability to change myself, to upgrade my human form with the aid of technology. To link my body directly with silicon. To become a cyborg -- part human, part machine. This is the extraordinary story of my adventure as the first human entering into a Cyber World; a world which will, most likely, become the next evolutionary step for humankind.

Kevin Warwick, **I, Cyborg**, Page 1

10.1 EXTENSION OF NERVOUS SYSTEM

Some people argue that rather than simulate natural intelligence (after all, that we already have) we should supplement natural intelligence with artificial intelligence. That is, we should shift emphasis from Artificial Intelligence (AI) to **Intelligence Amplification** (IA), from Simulation and AI (the focus of the last chapter) to Mediation and IA (the focus of this chapter).

Mountaineers scale mountains because they are there; psychologists study people because we are here. How did we get here? The theory of evolution explains only how we got to a hunter-gatherer society. The recent shifts from a hunter-gatherer society to an agricultural society to an industrial society to an information society have taken place in too short a time to be explained by the theory of evolution. Historical time is too short for the mechanisms of evolution to have much effect. It takes 500-1,000 generations for a survival-enhancing adaptation to become genetically encoded and we have had only about 100 generations since the birth of Jesus Christ. It is unlikely then that there is much genetic difference between our hunter-gatherer ancestors and you and I.

Alfred Russel Wallace had discovered the principle of natural selection at the same time as Darwin. Indeed, he published the same theory in the same issue of the same journal. He does not get as much credit as Darwin because he subsequently abandoned the theory. He could see no way in which adaptation to a hunter-gatherer society could explain the sophisticated modern mind.

How could a species, which evolved by adapting to a hunter gatherer society, deal with the dramatic shifts to an agricultural society, then to an industrial society, and now to an information society? This chapter presents one solution to this Wallace Paradox. During historical time, we have extended our nervous systems by developing tools for storing and transmitting information outside our bodies. The story of how we acquired those extrasomatic tools is the history of media. Thus, the history of media could be considered as a sequel to the theory of evolution. I've presented the history of media within this evolutionary framework in another book [GARDINER 2002]. Here is a condensed version of that book.

At the moment the sperm of our fathers met the ova of our mothers to create the zygote, the single cell which became us, Zog and Anu (our hunter-gatherer ancestors) and you and I were all given the conception-day gift of all the wisdom our species has accumulated over thousands of years of survival in a harsh arena plus three score and ten years to add our footnote to this wisdom. We were born wise. An important part of the conception-day gift is a means of storing information (memory) and a means of transmitting information (speech). Since a medium can be considered as any means of storing and transmitting information, Memory and Speech could thus be considered as the first generation of media.

This first generation of media is adequate for a hunter-gatherer society. We managed the transitions to an agricultural society, an industrial society, and now an information society over historical time by supplemented this first generation of media with three further generations of media. We have developed means of storing and transmitting information outside our bodies. We learned to store information outside our bodies in print and on film (second generation), to transmit information outside our bodies with telephone and television (third generation), and to both store and transmit information outside our bodies in multimedia and internet (fourth generation).

Carl Sagan distinguishes between tools which are outside the genetic code (**extragenetic**) and tools which are outside the body (**extrasomatic**) [SAGAN]. Since the storage and the transmission of information can be either extragenetic or extrasomatic, the four generations of media can be represented by the 2x2 matrix in Figure 10-1.

Note then that the development of media parallels the development of the person from animal to human (see Chapter 5) and from child to adult (see Chapter 6). It is a process of continuous discontinuity - continuous with respect to function (communication) and discontinuous with respect to structure (different media emerge in each generation).

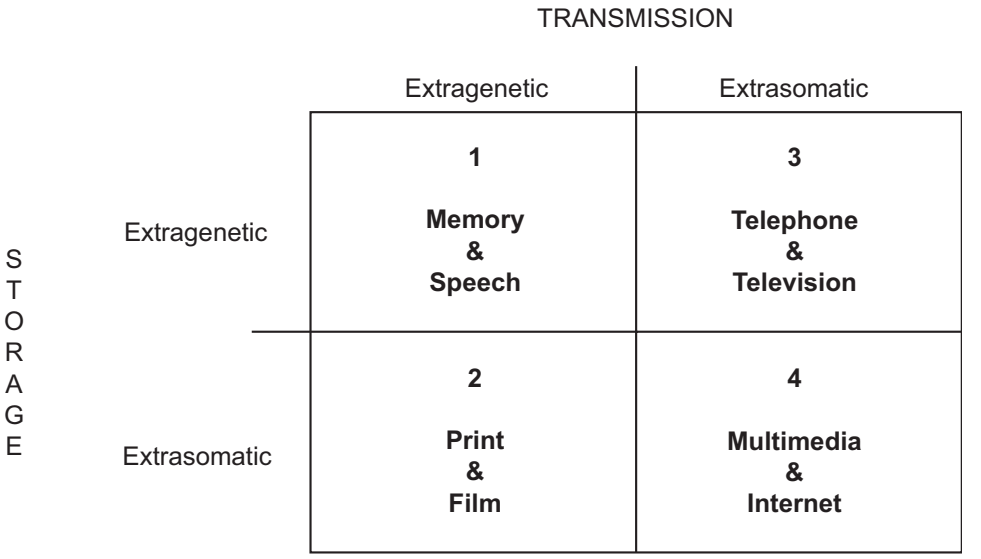

FIGURE 10-1 FOUR GENERATIONS OF MEDIA

10.2 TORONTO SCHOOL OF MEDIA STUDIES

John A. Macdonald, Canada's first Prime Minister, said "*Canada has too much geography and too little history*". Canada thus need transportation and tele-communications to hold the country together. It is held together with railway lines and telephone wires. It is no surprise then that the two greatest communication theorists are Canadian. The Toronto School of Media Studies was founded by Harold Innis (1894-1952) whose work was continued by Marshall McLuhan (1911-1980), whose work is being in turn continued by a group of scholars considered by their supporters as new McLuhans.

It is easy to write the history of an individual medium. The history of film or of television, for example, is simply a chronology of events. What is difficult is the description of the structural shift in society taking place as a new generation of media is assimilated. A basic focus of the Toronto School is such paradigm shifts. Since Innis died in 1952, before the assimilation of the third generation of telephone and television, his work will be used to describe the first shift; since McLuhan died in 1980,

before the assimilation of the fourth generation of multimedia and internet, his work will be used to describe the second shift; since the new McLuhans are still with us, their work will be used to describe the third shift we are currently all experiencing.

Harold Innis began his career as a political economist, working within the staples theory of the Canadian economy. Canada began largely as a rentier nation exporting its abundant natural resources and buying back the finished goods. Innis conducted careful studies of the fur industry, the cod industry, and the forestry industry.

However, under the influence of Thorstein Veblen, an eccentric economist at the University of Chicago, he realized that one should look at economics within the larger framework of ecology. An economy based on the consumption of non-renewable resources was disastrous for our ecology and doomed as an economic policy. If we sit back on our assets, we would become a Third World country in a post-colonial world in which the developed countries transform our raw materials into finished goods and skim off the profit. We would be "*hewers of wood and drawers of water*" until we ran out of wood and water, when we would be unemployed. Looking at the larger picture, Innis realized that what was printed on the paper was as important as the paper itself.

Thus began his studies of various civilizations in terms of the surfaces on which they chose to write their words and draw their images. If a civilization chose to use stone tablets, then they would conquer time (note that much Egyptian writing is still with us); whereas if a civilization chose to use parchment (the skin of animals), then they would conquer space. It is easier to carry around parchment than stone tablets. Note that the Romans were able to administer most of the known world using parchment. His final two books were wide-ranging explorations of civilizations, in terms of their relative emphasis on the conquest of time and space as a function of the media they used [INNIS 1950, 1951].

Since he had come from a study of paper to a study of what was written on the paper, he never lost sight of the importance of the medium. His most famous student, Marshall McLuhan, encapsulated this insight into his familiar aphorism: *The Medium is the Message*. McLuhan considers his work as a footnote to that of Innis. Part of that "*footnote*" is a metaphor for the structural shift as we assimilated the second generation of print and film. We traded an ear for an eye.

The major difference between the ear and the eye is that we have much more control over the eye than over the ear. We can choose not to see by closing our eyes. We have no earlids. We can train our eyes to focus on a point in space to see more clearly, but we can't train our ears to focus on a point in time to hear more clearly. What we see remains, what we hear is gone as soon as we hear it. We can train our eyes to move more precisely along lines and to jump from the end of one line to the beginning of the next line. When information is presented simultaneously to the eye and the ear as in television, the video dominates the audio channel in the famous **vampire effect**. When we moved from an oral to a literate society with the invention of writing, we thereby traded an ear for an eye. That is, we traded a time-based for a space-based communication system.

Innis had focused on the impact of the second generation of print. His major books, published in 1950 and 1951, were too early to pick up on the impact of the third generation of television. McLuhan took up his theme of the profound impact of media on society, and extended it to include the impact of our third generation of media - telephone and television. With this third generation, we crossed the digital divide from an infrastructure of transportation to an infrastructure of telecommunication. He also shifted focus from the level of the institution to the level of the individual. The various media were viewed as extensions of the person, as indicated in the subtitle of his major book: *Understanding Media: The Extensions of Man* [MCLUHAN M].

The timing of a theory is very important. If it is presented too soon, it is greeted as preposterous; if it is presented too late, it is dismissed as obvious. People say *What!* when innovators first present their ideas and, then - when the passage of time reveals their ideas to be sound - the same people say *So what?*. You have to time your theory to appear between the *What!* and the *So what?*. McLuhan seems to have suffered the fate of many innovators - his theory has gone all the way from preposterous to obvious.

Why were the ideas of McLuhan once preposterous?
He was the wrong man in the wrong place at the wrong time with the wrong message and the wrong medium.
Why are the ideas of McLuhan now obvious?
There is a new medium emerging and a new science evolving.

He is the wrong person. An English professor is expected to concentrate on the specifics of a particular writer in a particular time at a particular place. Thus, having studied the novels of James Joyce in graduate school, he should have settled down to a lifetime devoted to identifying the Dublin landmarks described in the novel *Ulysses* or whatever. He is not supposed to expound general theories about writing in general, far less *all* media, and far far less all human artifacts. If he is also a devout Catholic, then he is doubly suspect. Science is the province of the science and not the arts faculty, of agnostics and non believers. McLuhan has ignored the *trespassers will be persecuted* signs on the academic lawn.

In the wrong place. Canadians have a delightful diffidence, which can be most politely described as an excess of democracy. Self-deprecating statements by Canadians about Canadians include:

Canada has never been a melting pot; more like a tossed salad.
(Arnold Edinborough)

In any world menu, Canada must be considered the vichyssoise of nations --- it's cold, half-French, and difficult to stir **---**
(Stuart Keate)

A Canadian is someone who can make love in a canoe. **---**
(Pierre Berton)

John Kenneth Galbraith and Marshall McLuhan are the two greatest modern Canadians the United States has produced.
(Anthony Burgess)

The downside of this diffidence is that anyone who raises their head above the masses is in danger of having it chopped off.

At the wrong time. His theory is preposterous partly because it is premature. Theories are not supposed to predict the future but to postdict the past. McLuhan died in 1980 - that is, just before the explosion in multimedia and internet (our fourth generation of media) - which vindicated his theories. His genius was the recognition that the next step after the *transmission* of information electronically (third generation) was the *storage* of information electronically (fourth generation). He anticipated the dropping of the other shoe. It was only when we were startled by the sound of the second shoe dropping that we were able to be amazed that McLuhan anticipated it.

With the wrong message. In a lecture at McGill University, Bill Kuhns argued that the message of McLuhan is dismissed for the same reason as were those of Copernicus, Darwin, and Freud. Each of those innovators required us to break a discontinuity which we had erected to protect ourselves from a harsh reality. Copernicus broke the discontinuity between our planet and the rest of the universe. He tore us away from the centre of the universe and placed us on a broken-off fragment of a suburban star. We tried to burn him. Darwin broke the discontinuity between our species and our furrier friends further down the phylogenetic scale. We burned his books. Freud argued further that we are not the rational animal but a creature propelled by unconscious mechanisms. We simply burned. Kuhns argues that McLuhan is destroying a fourth discontinuity between the person and the machine. By arguing that our machines are extensions of ourselves, he is requiring us to take responsibility for them. There is still a whiff of burning in the air.

Using the wrong medium. If you proclaim the end of the medium, it is probably not a good strategy to use the doomed medium to do so. It is too easy to dismiss a book proclaiming the death of the book.[1] Nor is it a good strategy to use language in that book which is not appreciated as scientific. McLuhan's puns and probes were too playful for an academic public which is serious about science. McLuhan did not understand the importance of being earnest.

The theory of Marshall McLuhan has become obvious, because of the emergence of a new medium and the evolution of a new science. For a time, I considered using *Understanding Multimedia: Further Extensions of the Person* as a title for my book *A History of Media*. This title - which is (with a small adjustment for political correctness) an exact parallel to *Understanding Media: The Extensions of Man* - was designed as a homage to McLuhan. It concedes that all I am doing is updating the basic thesis of McLuhan that the media are best considered as extensions of the person. Homage to McLuhan *is* contained in *Mondo 2000: A User's Guide to the New Edge* [RUCKER ET AL]. Of the 51 concepts listed as characteristic of *the new edge* , the only name is Marshall McLuhan. Further homage is paid by *Wired* magazine, which lists him in their masthead as their Patron Saint and includes a quotation which demonstrates that an

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[1] When I was author-in-residence at Wadsworth Publishing Company, I told Jim Leisy, the President, that the book was dead. Since he made his living producing books, this was not good news. *Who said that? Marshall McLuhan*, said I, pulling one of his books off my shelf. *He said it in a book*, said Jim, thus clinching the argument.

obscure English professor from Toronto who died two decades ago best exemplifies the leading edge of technology and culture today.

McLuhan anticipated multimedia, which is clearly an extension of the person. Since it is integrative and interactive, it simulates the function of the corpus callosum, which integrates the left and right hemispheres and enables the interaction between the cortex and the rest of the body. It enables intelligence amplification, since it is finally a positive prosthetic which fits perfectly. He also anticipated the internet - the network of computer nodes interlinked by telecommunications. This infrastructure is the nervous system of the planet and thus the foundation of the **global village**. It is the means by which each person can extend him/herself around the globe.

When I took a sabbatical in the 1970s, it seemed obvious to go to California. This was, to use William Irwin Thompson's phrase, *the edge of history* [THOMPSON]. That was where one went to see the future now, and smile at some coming attractions and shudder at others. When I took a sabbatical in the 1990s, I gravitated through force of habit to California. However, it is no longer the edge of history. Because of multimedia and the internet, we have indeed moved into the global village, where, according to Marshall McLuhan, *the centre is everywhere and the periphery is nowhere*. Sitting here in the Smart Room of my Electronic Cottage in the village of Hudson, with my computer potentially linked to millions of other computers around the globe, I am as central as anyone in New York or London or Cupertino, California.

Kristina Hooper-Woolsey was showing me around the Apple Multimedia Lab. One of her colleagues, on hearing I was from Montreal, embarked on an enthusiastic exposition on a project on Glenn Gould he had just seen there. It was by Henry See, who had started by working on my 128K Macintosh during the night when I was not using it. At a conference on Virtual Reality, Ted Nelson suggested I go to Glasgow to meet Liz Davenport, the European representative of his Xanadu Project. She introduced me to two colleagues at the University of Strathclyde who were publishing *Hypermedia*, the first academic journal in the area. They in turn suggested I go to Copenhagen to visit Jakob Nielsen who had just published his book in the area, *Hypertext and Hypermedia* [NIELSEN]. Despite the ironic fact that he, alas, was in California, it became clear that the global village had arrived.

McLuhan was criticized for being unscientific. There was no coherent theoretical framework but simply a series of probes. Now that his

son, Eric, has published *Laws of Media*, which started out as a revision with his father of *Understanding Media*, he has presented a coherent theoretical structure. Now, it is dismissed as not a conventionally correct theory.

However, it is a theory designed not for the sociosphere or the ecosphere, the domains respectively of the social and natural sciences, but for the technosphere. This domain, which Herbert Simon calls the *sciences of the artificial* [SIMON], has been relatively neglected by philosophers and practitioners of science.

One principle that is clear, however, is that this is the domain of tools rather than of theories. This is what is implied by the statement that, in the MIT Media Lab, the motto is *Demo or Die* rather than *Publish or Perish* [BRAND]. You do not ask of tools if they are true but if they are useful. The **tetrad** (The major focus of *Laws of Media*) is a tool rather than a theory. This system of four questions requires us to think about the structural shift in the media system required by the assimilation of each medium. Is it useful? Emphatically yes. It permits us to consider systematically the complex structural shift produced by the introduction of a new medium on the system of media which precedes it. Each shift in our four generations of media is such a paradigm shift, yielding qualitatively different systems - from speech to speech-print to speech-print-video to speech-print-video-multimedia. This structural shift, rather than a sectorial shift, is the basic characteristic of organic systems.

To understand such a shift, we need a tool such as the tetrad. The ubiquitous is paradoxically elusive. The fish will be last to discover water. The tetrad introduces the fish to water, the person to the media in which we are immersed. Media may not be as broad as Eric McLuhan suggests (the over-generalization to all artifacts may be one reason why *Laws of Media* has been dismissed by critics), but it is broader than we tend to think. We tend to lose sight of media which is too close or too far. Thus, the first generation of speaking is so close that we see it as a part of ourselves rather than an extension of ourselves. Thus, the fourth generation of multimedia is so far, for those who are not yet familiar with it, that they see it as separate from themselves.

This brings us to a second distinguishing characteristic of the technosphere. Whereas the sociosphere has **observer effects**, the technosphere has **participant effects**. Those who view multimedia as a tool to extend themselves see it as a means of liberation, those who view it as a constraining environment see it as a means of oppression. The debate

continues because self-fulfilling prophecies provide both sides with evidence for their position. A medium only becomes an extension of those who use it. If you do not use it, it becomes an environment. Those who do not grasp it as a tool, and thereby extend themselves, are victims of it because its use by other people creates the environment in which they are living. If it is not part of your solution, then it is part of your problem. Or, as the cyberpunks more rudely phrase it, *if you are not part of the steamroller, then you're part of the road*.

A number of young scholars, each heralded by their supporters as the "*new McLuhan*", are carrying on the Toronto School tradition of Innis and McLuhan. Whereas Innis focused on the first transition, McLuhan on the second transition, those young scholars are focusing on the third transition which is currently taking place.

The first of those (in order of seniority) is Robert Logan (1939-). His three major books within the Toronto tradition are *The Alphabet Effect* [LOGAN 1986], *The Fifth Language* [LOGAN 1995], and *The Sixth Language* [LOGAN 2000].

The second is Paul Levinson (1940-). His most recent books are *The Soft Edge: A Natural History and Future of the Information Revolution* [LEVINSON 1997] and *Digital McLuhan: A Guide to the Information Millennium* [LEVINSON 1999].

The third is a McLuhan literally as well as metaphorically. Eric McLuhan (1941-), a son of Marshall McLuhan, worked with his father on *Laws of Media* [MCLUHAN M & MCLUHAN E]. Although this book started out as a revision of *Understanding Media: Extensions of Man,* it finished up when finally published 8 years after his father's death to contain as much of the point of view of Eric as of Marshall. Eric has since published a book on his own entitled *Electric Language* which continues to explore his perspective [MCLUHAN E].

The fourth is Arthur Kroker (1945-) who, as the only Montrealer in the Toronto School, is appropriately more flamboyant. After a traditional book, *Technology and the Canadian Mind* in which he brilliantly surveyed the work of Innis, McLuhan and George Grant [KROKER 1984], he has produced a spate of un-traditional books on the fourth generation of media - for example, *Spasm: Virtual Reality, Android Music, Electric Flesh* [KROKER 1993] and *Data Trash: The Theory of the Virtual Class* [KROKER & WEINSTEIN].

The fifth is Derrick de Kerckhove (1946-), who was a student and colleague of Marshall McLuhan before taking over his position as Director of the *McLuhan Program in Culture and Technology*. His two major contributions to the Toronto tradition are his recent books - *The Skin of Culture: Investigating the New Electronic Reality* [DE KERCKHOVE 1995] and *Connected Intelligence: The Arrival of the Web Society* [DE KERCKHOVE 1997].

The "baby" of the group is Bruce W. Powe (1955-). He wrote a book describing Marshall McLuhan (along with two other Canadians, Pierre Trudeau and Glenn Gould, an almost-Canadian born on a yacht off Amherst, Nova Scotia, Wyndham Lewis, and an Italian, Elias Canetti) as *The Solitary Outlaw* [POWE 1987]. No doubt impressed by a country in which the Prime Minister for 16 years can creditably be described as a "*solitary outlaw*", he went on to do a very unCanadian thing - he presented a glowing picture of our country as *A Tremendous Canada of Light* [POWE 1993]. His exploration of the impact of the fourth generation of media continues with *Outage: A Journey into Electric City* [POWE 1995].

Although his major focus is the role of the intellectual in a world of declining literacy, Powe could be better described as a poet rather than a scholar. Of the other five *"new McLuhans",* only Levinson is trained within the discipline of communication studies. The others are scholars in various different disciplines - Logan is a physicist, Eric McLuhan followed his father into English Literature focusing on the work of one of his father's heroes, James Joyce, Kroker is a Political Scientist, and de Kerckhove was a Professor in the Department of French. In this sense, they also follow in the Toronto tradition - Innis studied political science and McLuhan studied English Literature. All members of the Toronto School transcended their disciplines to become generalists. The diversity of points of view they therefore bring to Media Studies accounts for much of the richness of the tradition. The continuation of the Big Story of historical time - the co-evolution of the person and media as extensions - is in good hands.

10.3 WHAT KIND OF CYBORG DO YOU PLAN TO BE?

There has been much focus recently on the cyborg. This entity - part-person and part-machine - lies somewhere along this dubious dimension between person and machine, and thus challenges the dichotomy of person and machine. It has been a staple of science fiction for some time, especially in the sub-genre of cyberpunk. However, it is beginning to appear more and more in popular culture. A spate of feature films have 'starred' various cyborgs - for example, *Terminator*, *Robocop*, *Cyborg*, *Lawnmower Man*, *Johnny Mnemonic*, *Solo*.

Even scholars have shown some recent interest in cyborgs under various aliases - e.g. post-human [HAYLES] or micromen [PASK & CURRAN] or metamen [STOCK]. Kevin Kelly proposes a "*new biology of machines*" [KELLY]. We even have a Cyborg Handbook [GRAY ET AL] and a Cyborg Manifesto [HARAWAY]. Of course, the fact that the academy has 'discovered' the issue could mean - as some cynics say - that it is passé! However, this academic for one thinks the cyborg issue will be with us for some time, and that the cyborg will become a major metaphor of this millennium.

During a conference in Baden Baden, Germany, I argued that we are all cyborgs. We can 'look forward' to becoming more and more cyborgian as we age and require glasses, false teeth, a hearing aid, insulin shots to control our diabetes, a pacemaker to charge up our heart, perhaps even an artificial limb or two. The machine parts we may require as we age are, of course, prosthetics to replace malfunctioning organic systems. While perhaps inevitable, this may not be the type of cyborg we aspire to be. I suggested that we replace the perennial question *What do you want to be when you grow up?* with the question *What kind of cyborg do you plan to be?*

If we turn for inspiration to the fictional characters in cyberpunk novels and in the films mentioned above, we note that they have **positive prosthetics.** That is, whereas they may replace missing organic parts, they are superior to those parts and, in some cases, they are added to a perfectly functioning body. For example, whereas our eye-glasses merely return our failing sight to normal, the goggles, worn by Hiro, the hero of *Snow Crash*, expand his sight beyond the visual spectrum [STEPHENSON

1992]. We have now all seen such goggles in action in the recent Operation Iraqi Liberation (OIL).

The prosthetics may be positive but they are not necessarily used in positive ways. The characters in the *Matrix Trilogy* (*Neuromancer, Count Zero, Mona Lisa Overdrive*) by William Gibson have positive prosthetics which are usually weapons necessary to survive in his apocalyptic vision of the near future [GIBSON W 1984, 1987, 1988]. Eve, the eponymous heroine in *Eve of Destruction*, has a nuclear bomb in place of a womb and must therefore be treated very carefully. Let us focus on prosthetics which are positive in both senses - constructive rather than destructive tools.

The argument that we are all cyborgs sensitizes us to the bewildering smorgasbord of cyborgs we encounter in day-by-day life: a courier on a bicycle, a kid on a skateboard, a middle-aged man reading a book, a teenager carrying a boom-box, a cybernaut with goggles and gloves exploring cyberspace, and so on. Those are all temporary cyborgs who pick up and put down their appendices or, in the case when they wear their appendices, put them on and take them off. From time to time, someone advocates they be permanently implanted. Younger people, who have no qualms about tattoos and body piercing, may find this option of implanted intelligence interesting. Indeed, there seems to be no shortage of candidates with a "*desire to be wired* " [BRANWYN].

Whether carried or worn or implanted, the various appendices are of two types - those which expand the body as an energy system (bicycle and skateboard) and those which expand the mind as an information system (book, boom-box, goggles-and-gloves). The former are of little theoretical interest. The bicycle and the skateboard are means of getting the person from point A to point B. If the trip is uneventful, the person is essentially unchanged at the destination. The latter are more interesting, since the person is changed by the acts of reading the book, listening to the music, exploring cyberspace. Let us focus, therefore, on the latter - on systems involving bits rather than atoms [NEGROPONTE].

THE EXTENDED PERSON - W. LAMBERT GARDINER

The decision to focus on positive prosthetics which extend us as information systems leads to a consideration of media - the 'machines' which store and transmit information. I argued above that the co-evolution of the person and media is the Big Story of historical time. The conception-day gift of memory and speech is adequate only for a hunter-gatherer society. Over historical time, we had to extend our nervous systems by storing and transmitting information outside our bodies to manage the transitions to agricultural, industrial, and now information societies. That is, history is the story of the cyborgization of the person. How do you plan to use those extragenetic and extrasomatic tools? What kind of cyborg do you plan to be?

Each of those generations of media extends us as information systems, since they enable us to share information with other people. The fourth generation - in which information is stored electronically in disks and transmitted electronically through the informatics infrastructure of computers interlinked by telecommunications - is, however, particularly powerful, because it is more integrative and interactive. Since numbers, text, images, sounds can all be reduced to a lowest common denominator of 0s and 1s, the products of the generations can be integrated in electronic storage. Since the person can interact intimately with this electronic information, the person and the machine can be tightly coupled. This rich feedback between person and machine creates a cybernetic organism (cyborg) as the term was originally intended. We now have a positive prosthetic which is a perfect fit.

We usually consider media as mediating between people. However, they can also be considered as mediating, within each person, between the subjective map and the objective world. The subjective map could be considered as composed of a perceptual map and a conceptual map, corresponding roughly to the thing and the word in the objective world and to text- and image-based media, as depicted in Figure 7-1. It is a useful metaphor to consider the perceptual map as a function of the right hemisphere and the conceptual map as a function of the left hemisphere. Within this metaphor, the computer could be consider as the corpus callosum. This captures the two basic characteristics of computer-based media - integration and interactivity. The corpus callosum links the two hemispheres, as the computer integrates text and image, and it links the cerebral

cortex with the rest of the body, as the computer provides interactivity between thought and action.

We finally have a medium which represents the whole nervous system, a positive prosthetic which fits, a three-dimensional tool which mediates between our three-dimensional brain and our three-dimensional world, we have to reconsider our current dependence on one- and two-dimensional tools, and our continuing use of the computer as a box to bury old one- and two-dimensional media. We typically use the computer as a typewriter to do one-dimensional word-processing. It is necessary to proceed to two-dimensional idea-processing, in which the computer is used to generate the hierarchical structure of thought underlying the sequential presentation of language, and to three-dimensional multimedia, in which it is used to nest more nodes within any node and to link any two nodes within the hierarchy (Figure 10-2). This three-dimensional structure is isomorphic with the cognitive structure of the subjective map, viewed as concepts with relationships between them, and with the informatics infrastructure of the objective world, viewed as computers interlinked with telecommunications (Figure 10-3).

Each of us fortunate enough to have a few thousand dollars to spare has, at our fingertips, the power available only to multinationals for millions of dollars only 40 years ago. One way to realize this power is to use multimedia to create a conceptual self-portrait, a sort of expert system of oneself. The **Siliclone** - that is, a silicon clone of oneself - is a primitive prototype. My Siliclone has evolved from a HyperCard-based filing cabinet of one's favorite quotes, anecdotes, images, sources, and so on to a website at www.siliclone.com, as depicted in Figure 10-4. Person-machine synergy can be explored as the appropriate division of labor between your natural intelligence and the artificial intelligence in your satellite brain, or, more precisely in my case, between Scot and Siliclone. As in any partnership, the division of labor is based on the competencies of each partner.

One view of the division of labor is that Siliclone deals with content, setting Scot free to deal with context. That is, data is placed in context to yield information, information in context to yield knowledge, knowledge in context to yield understanding, understanding in context to yield - God forbid - wisdom. This is how value will be added to raw data to generate wealth in our information society. This data-wisdom hierarchy is not as clear as it seemed then. Wisdom is more of an inside-out process, based on the unfolding of the human potential in the zygote from the inside out rather than on the contextualization of data from the outside in.

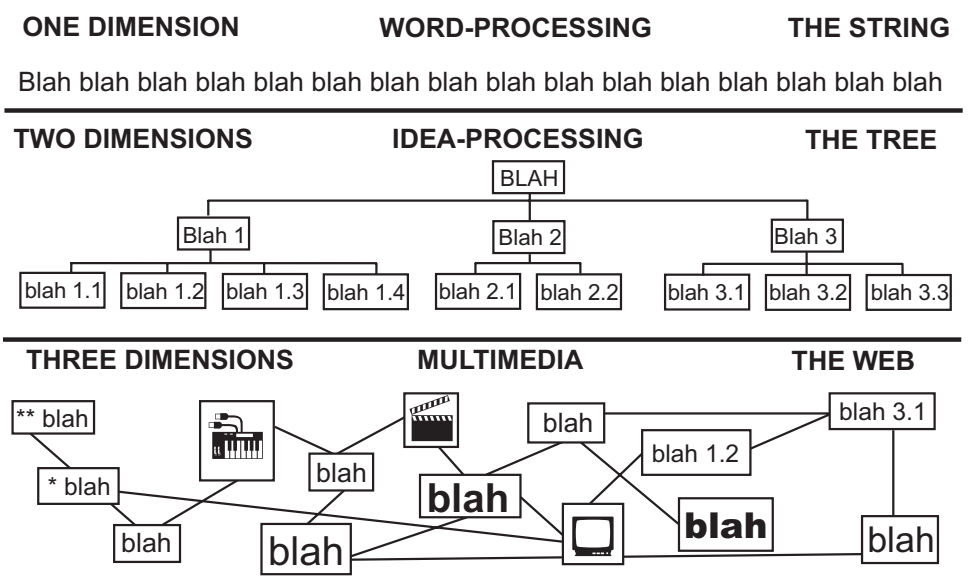

FIGURE 10-2
ONE, TWO, THREE-DIMENSIONAL COMPUTING

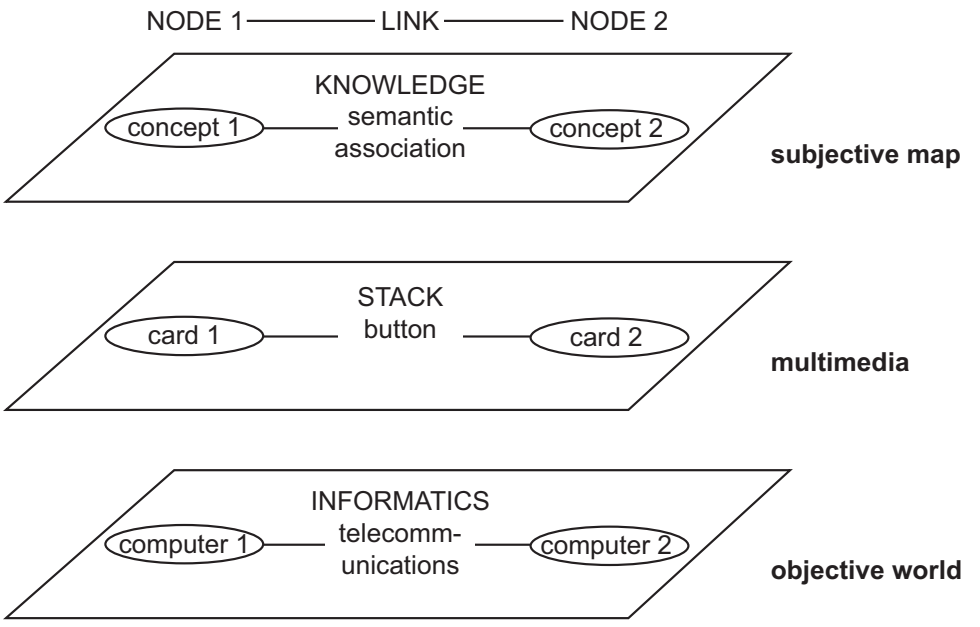

FIGURE 10-3 ISOMORPHISM OF NODES AND LINKS

A second view is in terms of clutter and complexity. Information overload is often described as *the* basic problem of the post-industrial society. In the industrial society, we had too little energy; in the post-industrial society, we have too *much* information. However, this is like surveying a huge smorgasbord and complaining about overload because we can not eat it all. In our outside-in education, in which being educated is viewed as stuffing oneself full of facts, we are overwhelmed by the fact that we could not even assimilate the contents of our local library in our lifetime. The inside-out teacher, who views education as growing from the inside out, welcomes our enriched environment. One of the few conclusions we psychologists have reached is that so-called stupid people grow up in impoverished environments and so-called smart people grow up in enriched environments. Beneath the pseudo-problem of information overload, however, there lurks a real problem of **management of complexity**. Our enriched objective world enables us to build a subtle, sophisticated subjective map of it. However, true complexity must be distinguished from mere clutter. The siliclone can be viewed as a means of removing the clutter of content so that one can see more clearly.

A third view is in terms of means and ends. The 'sili' in siliclone was originally seen as referring, of course, to silicon. However, it is beginning to carry an additional 'meaning'. We are all familiar with people who are not so much stupid as silly. Silliness refers to ends whereas stupidity refers to means. Silly people use perfectly good means to trivial ends. The Siliclone is 'silly' in this sense. It has powerful means but no worthy ends. The capacity for meaningful ends is the domain of natural intelligence. We should subsume means to ends by sub-contracting out means to our respective siliclones.

FIGURE 10-4 THE SILICLONE

THE ENHANCED PERSON - ANDY CLARK

Andy Clark (1957-) argues that our human destiny is, paradoxically, to become a cyborg [CLARK]. Our very plastic brains are designed to merge with media. The really important media mergers are thus not AOL with Warner or even Google with YouTube but the merger of the mind with media. We think quite literally outside the box. The system which does the thinking is not the brain, as most cognitive psychologists

have assumed, but the integrated system of the brain and its various extensions.[2]

Merlin Donald argues that the mind is assumed not only to be empty (tabula rasa) but to be isolated (tabula isola). That is, we tend to think of thinking as the function of a single mind [DONALD]. However, whether language and thought evolved because we were hunters or because we were hunted, it evolved in a social context. Language and thought evolved to serve the group. It evolved for cooperation not conflict. Our cognition subsequently was adapted to serve the individual, and to fuel conflict between individuals. However, we must recognize its positive social origins.

Andy Clark challenges the tabula isola assumption in another sense. Over historical time, we have invented extrasomatic tools to extend the nervous system by storing and transmitting information outside our bodies. Thus, the cultural evolution which has recently supplemented the biological evolution involves the mind "thinking" with its extensions. The brain is relatively inept on its own. I can multiply two one-digit numbers "*in my head*" only because I have memorized the multiplication tables. When confronted with a problem as simple as multiplying two two-digit numbers, we find ourselves reaching for pen and paper.

Clark would thus agree that the Big Story of historical time, as told above, is the co-evolution of the person and media as extensions. However, whereas I view this process as the piggy-backing of cultural evolution on biological evolution and thus we do not differ essentially from our hunter-gatherer ancestors, Clark suggests that we are different from them. During the long period of infant dependency, our brains are molded by the media available to us. Our minds are not hunter-gatherer minds in new technological clothing, but are primed to merge with what media they find and what media they themselves create. Media do not simply extend minds but they change minds.

William Calvin wondered why brain damage affected the reading ability of his father. Surely reading, unlike speaking, is acquired culturally rather than biologically, and thus could not be affected by damage to a par-

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[2] This is why I never note any half hour period devoted to "pure" thinking when I keep a record of time spent communicating. There is always some accompanying communication act. This is why I don't know what I think until I hear what I say or read what I write.

ticular area of the brain? He concluded that "-- *reading abilities are wired up on the fly during childhood -- as we say, they are 'soft-wired' during development rather than hard-wired in the manner of instincts*" [CALVIN, Page 141]. Perhaps the various extrasomatic tools we have acquired over historical time have been so "soft-wired" into our nervous systems as extragenetic tools. They thus become part of the processing system rather than just part of the content which is processed. We learn to read and then we read to learn.

Select one of those five cards
Stare at it for 30 seconds
Turn to the next page

Clark proceeds to document some interesting features of the latest element in this integrated person-media cognitive system - what I have presented as the fourth generation of media, Multimedia and Internet. The internet is traditionally viewed as an anarchist system which works amazingly well despite the fact that there is no central control. Clark points out that it works well BECAUSE there is no central control. And thus it is free to organize itself. It thus joins the self-organizing systems designed by Mother Nature rather than by our limited selves. Google works better than the search engines which preceded it because it is based on this self-organization rather than by superimposing our clumsy key-word system on it. It is based on the trails left by the millions of surfers on the internet. Thus it takes you to where the best information on your topic is located, based on the fact that other people interested in this topic voted with their fingers for the best websites.

FIGURE 10-5 CARD EXPERIMENT - ANDY CLARK

Clark uses a number of examples like this (Figure 10-5) to illustrate that, without our extensions, we just get the gist of a situation. We just record five face cards and do not notice that ALL the cards have been changed, and thus *whatever* card we chose is gone.

THE GOGGLED PERSON - STEVE MANN

My ten top reasons why the virtual world is better than the real world are listed in Figure 10-5. I was just joking. Steve Mann is serious. He has lived in the virtual world for 20 years [MANN & NIEDZVIECKI]. Every morning he dons his wearable computer (wearcomp) apparatus before he opens his eyes and takes it off again in the evening after he closes his eyes. After graduating from MIT, he came home again to Canada, where he is a professor at the University of Toronto. His apparatus has got less and less cumbersome over those 20 years and his wife Betty has joined him in cyberspace.

He would add a number of other reasons to my top 10. One is that the virtual world is relatively less explored than the real world and he can

thus, as a scientist, be a pioneer in learning about it. In described the mobile movie-studio-cum-theatre of the mind, I said that the movie theatre has only one seat. I therefore have to learn to write to tell you about my home movie.

Steve's theatre is not as limited. His wife can watch his home movie along with him. He can show as well as tell. Betty can see the world as Steve sees it. Advantages range from the trivial - they can shop together when she remains at home - to the profound - she can empathize with him as they share experiences. Another limitation of Steve's unaided nervous system is that the record of his experience is accessible only to himself. Wearcomp can record what Steve sees and Betty can relive his experience later.[3] This record is more accurate than the record previously available to the natural brain, which is subsequently "edited" to tell a better story.

We are all participant observers in our own lives. There's a need for balance between being too much a participant (*The unexamined life is not worth living*) and being to much an observer (*The unlived life is not worth examining*). Does Steve's strategy push him into the latter extreme? Is he watching his own life as if it were a movie rather than living it? Is he volunteering to be the eponymous hero of his own version of *The Truman Show - The Mann Show*? Or does he gain MORE autonomy, as he claims, by being able to edit and annotate his environment, being able to survey the surveillers, and being able to learn by being as well as by doing?

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[3] Philippe Ramsay-Lemieux, one of my students, went to Boston to interview him. Later, Steve showed Philippe the interview from his point of view on his computer - he had been recording Philippe as Philippe was recording him.

1 There is no musical score or laugh track.

2 You have to do all your own stunts.

3 It's always in technicolor. You can only have black-and-white movies at night.

4 There is no UNDO function, RESET button, or ESCAPE KEY.

5 You can't REWIND, FAST FORWARD, PAUSE, or have SLOW-MOTION INSTANT REPLAYS. Your eyes can PAN but they can't ZOOM.

6 Your marriage lasts till "death do you part" rather than until the film is in the can or the TV series is cancelled.

7 You can't channel-surf through your various other possible lives.

8 You can't shop for a new body, head as you can for your avatar.

9 Your mobile movie studio doubles as a movie theater but there is only one seat.

10 You can only die once and you have to leave it until the end. There are no happy endings.

FIGURE 10-6
TEN TOP REASONS WHY REAL WORLD IS INFERIOR TO VIRTUAL WORLD

THE IMPLANTED PERSON - KEVIN WARWICK

Kevin Warwick is a cyborg. On 20 April 1998, he had a silicon chip inserted into his arm. It is contained in a glass capsule 23 millimeters long and 3 millimeters wide. In conjunction with some equipment built into his house, the chip greets him as it opens his door, turns on lights when he enters a room and turns off lights when he leaves it, and keeps a tally of the mail in his e-mail box [WARWICK].

Before that date, Kevin Warwick was relatively obscure, despite the fact that, as a professor of cybernetics at the University of Reading, England, he had acquired over 4 million dollars in grants and had written over 400 papers. He is now famous. Many of his academic colleagues are critical of his fame. It's okay perhaps for a scholar to be a visionary but he is suspected of becoming also a missionary. Scholars don't like the missionary position.

On 14 March 2002 at 8:30 a. m., Warwick moved into the next phase of his research (code-named Cyborg 2.0). This time the chip is not only implanted but linked to his nervous system. This time, his wife Irena will be similarly equipped. This time, they want to explore various questions previously considered only in scifi novels. Can emotions such as intoxication, anger and lust be read by the computer in terms of patterns of nervous excitement? Can states like intoxication and sexual arousal also be read? Can these recorded emotions and states be beamed back to the chip in the body and experienced all over again? Can those emotions be communicable between two people? Warwick plans to go to New York to see if the desire he experiences in New York will be felt by his wife back home in London? Will they be able to read one another's mind and communicate by telepathy? Will the dream of direct communication with no mediation even by first generation of speech be realized? Will it change forever what it means to be human? Will this spell the end of the faked orgasm?

It is difficult to find out what answers are emerging from this research. We would assume that Kevin Warwick has a huge presence on the internet. However, his official web site - *www.kevinwarwick.org.uk* - has disappeared into cyberspace, leaving no forwarding address. There is no shortage of places to go to read about him - *Kevin Warwick Watch* makes

sighting forms available to keep track of his activities, *Register* documents the adventures of Captain Cyborg, and there are countless interviews of him and articles on him in the various hip magazines. They alas have axioms to grind. It's weird to be wired.

Kevin and Irena have two children, neither of whom have as yet been fitted with a chip. However, a family in Florida has [GROSSMAN]. Pets have been fitted with chips, so that you can avoid quarantine by demonstrating that they have had the required shots. Also they help find them if lost. Next obvious step is to have chips inserted in children, so that they can be found if lost or kidnapped. A chip could also contain a medical record so that appropriate medical procedures can be used in an emergency. This is the thin edge of the chip which could lead to chips being more acceptable.

CHAPTER 11
BIOLOGY –
THE LEVEL BELOW

The blueprints, detailed instructions, and job orders for building you from scratch would fill about 1,000 encyclopedia volumes if written out in English. Yet every cell in your body has a set of these encyclopedias.

Carl Sagan, **The Demon-Haunted World**, Page 330

So there are three kinds of living systems - organisms, parts of organisms, and communities of organisms - all of which are integrated wholes whose essential properties arise from the interactions and interdependence of their parts. ..... In other words, the web of life consists of networks within networks. At each scale, under closer scrutiny, the nodes of the network reveal themselves as smaller networks.

Fritjof Capra**, The Web of Life**, Page 34

11.1 BOXES WITHIN BOXES

This book so far has focused on the psychological level of analysis - it is, after all, entitled *The **Psychology** of Communication*. My argument is that psychology is the study of the nervous system, with the other subsystems of the body considered as internal environment (Chapter 2) and the nervous system is part of a hierarchy of systems within systems (Chapter 3). In the next two chapters, the focus will shift to those other levels of analysis. This chapter will focus on the level below psychology - biology, and the next chapter will focus on the level above psychology - sociology.

Scholars at those various levels often squabble among themselves, with scholars at a higher level complaining about **reductionism** and scholars at a lower level complaining about **emergentism**. Edward O. Wilson met both criticisms when he published *Sociobiology: The New Synthesis*, using biological terms to discuss sociological phenomena [WILSON 1975]. Sociologists complained about "reducing" their discipline to the biological level and biologists complained about focusing on the properties "emerging" from their discipline. Since new phenomena do indeed emerge as one moves up to a higher level (the whole IS greater than the sum of its parts), no level can indeed be reduced to the level below. Each level thus provides a unique contribution to the psychology of communication.

In the behavioristic approach (Chapter 2), we represented the nervous system as an empty box dealing only with input information; in the humanistic approach (Chapter 3), we put another box into this box representing stored information; in the interactionist approach (Chapter 4), we added another box so that we could also deal with fedback information. We called those boxes within the box Image and Program, by analogy with the computer. Those boxes within boxes are **hypothetical constructs** designed to provide us with a more sophisticated concept of the nervous system.

New tools - for example, **Magnetic Resonance Imagining (MRI)** which provides a 3-D image of the brain and **functional Magnetic Resonance Imagining (fMRI)** which lights up this 3-D image with the parts which are active - promise to enable us to identify the actual biological

structures which correspond to those hypothetical constructs.[1] Research using such devices reveal that the nervous system is much more complex and subtle than even our most sophisticated model.

The computer is a very clumsy simulation of the nervous system. Let us go back to basics and consider how Mother Nature designed that first generation of media which we have extended with the clumsy, person-made media of the second, third, and fourth generations. Since memory and speech are included in the conception-day gift, there must be some biological basis to them. Let us look at each in turn.

11.2 BIOLOGICAL BASIS OF MEMORY

I tell you something today and you repeat it back to me tomorrow. In the interval, it must have been retained somewhere somehow in your nervous system. Karl Lashley devoted a lifetime to find where and how this "*engram*" was stored [LASHLEY]. He finally concluded that he could not find it anywhere because it was everywhere. **Memory** is stored in every cell of your body. Karl Pribram, one of the three brilliant young men who developed the TOTE unit, later reached the same conclusion when he argued that the nervous system contains holograms rather than photographs. Every element in a hologram contains the whole image.

James V. McConnell suggested that it may be stored in **ribonucleic acid (RNA)**, a biological cousin of **deoxyribonucleic acid (DNA)**. He was the leader of a group of psychologists who studied learning in worms [MCCONNELL]. A worm was taught to turn right in a T-maze by arranging that there was some nice mud on the right and a shock on the left. They minced up the worms and fed them to other worms, and found that those **cannibal worms** took significantly less time to learn to go right than worms which had fed on untrained worms. Since all that survives being minced and eaten is chemistry, this information must

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[1] When I wrote introductory psychology textbooks in the 1970s, I devoted a section to the **reticular activating system** (RAS). This was a system in the lower brain which projected diffusely on to the cortex and was viewed as the biological basis of consciousness, awareness, attention. When I returned to writing about psychology 30 years later, I found that this important concept had disappeared. It turned out that it was a hypothetical concept which was no longer hypothetical. The structure which performed this function had been identified as the amygdala.

have been transmitted chemically. Subsequent research pointed to RNA as the relevant chemical. This research was not refuted in the usual way by replicating the experiments and getting different results. It was simply ignored [INGRAM, Pages 77-86]. It did not fit within the paradigm current at the time.

This conclusion, which seemed preposterous at the time, is now if not obvious at least less preposterous. With the breaking of the genetic code, we now know that the "memory" our species has acquired over hundreds of thousands of years of evolution is stored in DNA in every cell of our body, we may be more open to the argument that the ontogenetic memory each of us adds to this phylogenetic memory during our few decades on the planet may be stored in RNA in every cell in our nervous system.

However, even if we concede that this is how memory is stored, we need also explain how it is acquired and retrieved. Even the simple-minded metaphor of memory as a data bank requires a distinction between the processes of deposit and withdrawal and the process of storage. When you withdraw a hundred dollars from your bank, you do not expect to get the same 5 20-dollar bills you deposited the week before. You know that that money has been assimilated into the abstract whole of the bank's assets.[2] The most popular thesis is that learning (deposit) is the creation of a neural circuit by breaking down the gaps between cells and remembering (withdrawal) is the reactivation of this circuit. Donald O. Hebb hypothesized that such circuits, which he called **cell assemblies**, are created in the cerebral cortex [HEBB]. Subsequent research reveals that the lower brain plays a role in the creation of such circuits.

As you are adding up a column of figures, you keep in mind the subtotals after each figure. It would serve little purpose to retain all this information since you need it only for a short time. Nature has ingeniously designed a dual memory system consisting of **short-term memory** for such functions and **long-term memory** for storing information which may be retrieved later. In the former case, the impulse does not cross the synapse (the gap between the cells) often enough to create a cell assembly. The **hippocampus**, a structure in the lower brain, plays a role in

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[2] Changes in bank architecture suggest that bankers and their clients are aware of this. Banks built like fortresses of stone and steel to protect the money have been replaced by banks with open offices showing clients the activity that generates interest on this money.

the transformation of short-term into long-term memory.[3] It replays each cell assembly - consciously when you recall it and unconsciously when you sleep - to stamp it in during the early stage when it is vulnerable to extinction. Such a dual system removes the clutter of the sub-steps in a process, unlike our clumsy computers which retain every keystroke.

Further dichotomies show that memory is more complex than we may at first assume. During a personal energy crisis, I bought a bicycle. Though I hadn't ridden a bicycle for 40 years, I hopped right on and rode it right away. Two weeks later, I couldn't ride my bicycle. I had forgotten the code for the bicycle lock. Surely the memory of how to ride a bicycle, which had survived for 40 years, is qualitatively different from the memory of the code, which did not survive for a few days. Memory experts indeed do make a distinction between **procedural memory** (riding the bicycle) and **semantic memory** (remembering the code). Such procedural memory is a function of the **putamen**, a structure in the lower brain. Nature thus contracts out memory for action to a system which reliably retains this information.

Wilder Penfield found evidence that memory is localized in a particular place within the cerebral cortex [PENFIELD & ROBERTS]. He was operating on patients suffering from epilepsy by removing the area of the brain which triggered the epileptic seizure. He dropped an electrode into the brain of the patient to make sure that the affected area is not part of the speech centre. If it was, the cure would be worse than the disease. When he dropped the electrode into the temporal lobes of patients, they reported experiencing events in their pasts. (Such an operation can be conducted while the patient is fully conscious, since there are no pain receptors in the brain.) It was a rerun of a past event with all the accompanying sights, sounds, smells, tastes, and touches. When Penfield lifted the electrode and dropped it again into the same place, the relived experience continued where it had left off. It was as if the patients had a complete videotape of their pasts which could be played by triggering it with an electrode.

He had located a site of **episodic memory,** where the content is in the context of one's life. It is of course a heavily-edited version containing only the sliver of whatever was available in your environment. The sliver is chosen by your amygdala, another structure in the lower brain,

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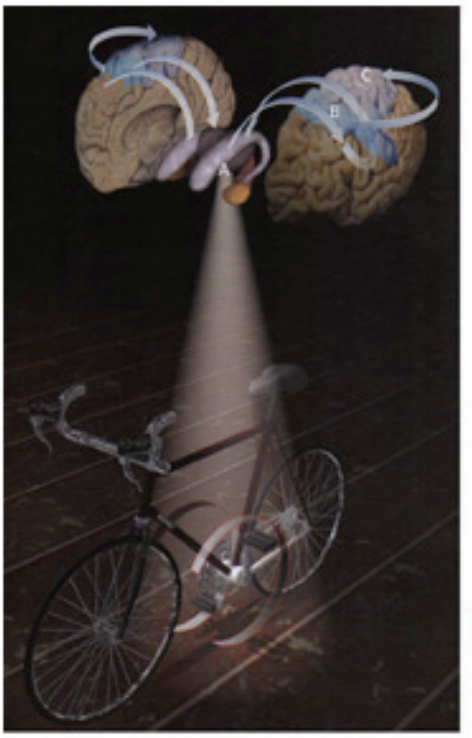
[3] The hippocampus is also involved in spatial navigation. London cabbies are required to acquire "the knowledge", involving 37,000 roads and 320 routes between important points within a 10-kilometer radius of Charing Cross, to qualify for their licenses. Scans of the hippocampus revealed that their hippocampuses were significantly larger than average and grew with the job.

which controls your attention. Semantic memory becomes abstracted from episodic memory when it is removed from the concrete context in which it was learned. Subsequent research reveals that the amygdala consolidates the sights, sounds, tastes, smells, and touches, from the various reception areas for those senses in the cortex into a single "episode". The elements of the episode remain in their respective reception areas. Thus, triggering any one of those elements (as Penfield did) resurrects the whole episode. Once again, nature ingeniously designs a system which provides many "handles" to retrieve our past experiences.

Every type of memory thus involves a structure in the lower brain - the hippocampus, the putamen, and the amygdala are involved respectively in long-term, procedural, and episodic memory (see Figure 11-2). This lower brain is a primitive layer of our brain which we share with all mammals. Thus memory has been a function of our species for a very long time. There is much talk about the evolutionary function of speech, as the essential difference between us and the other animals. However, it would be of little value if not combined with memory, which we share with other animals. Memory enables us to benefit from our own experience, whereas memory-and-speech enables us to benefit from the experience of others. We differ from the other animals not so much because of learning but because of teaching. However, we are not separated from our animal past. Our old brain still plays a role. Indeed there is much more traffic from the old brain to the new brain than from the new brain to the old brain. We remain wired for emotion rather than for reason.

Helen Keller reported in her autobiography that, when her teacher Ann Sullivan poured water into one of the hands and wrote "water" on the other hand, she suddenly realized that the word "water" represented water [KELLER]. That is, that something can be a symbol for something else. She rushed around demanding the symbols for familiar objects. This eureka moment was the beginning of a process which transformed a blind and deaf child into a competent and scholarly woman. There was a similar moment in the development of our species, when symbolization linked memory to speech. Perhaps the Big Bang of the Brain had more to do with the merging of memory and speech than with the acquisition of speech itself.



(a) Putamen (A) triggers the Premotor cortex (B) which triggers the motor cortex (C)

(b) More upward links from old to new brain than downward links - primed for emotion

(c) The various structures in the limbic system involved in memory

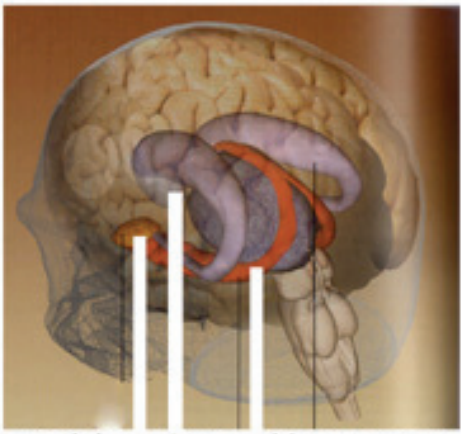


FIGURE 11-1 BIOLOGY OF MEMORY

Traditional evolutionary theory describes the process as gradual. However, some evolutionary theorists suggest that it may sometimes be sudden, and cite the Big Bang of the Brain as a prime example [GOULD]. This debate, whimsically described as *evolution by creeps* versus *evolution by jerks,* could be resolved by the argument that the formation of modules is gradual but the linking of modules could be sudden. It's very unlikely that a module for speech or a module for memory could suddenly appear but it is possible that the merging of those modules could be sudden.

Memory (however nature designs it) is the foundation of all media (however we design them). This primacy of memory is recognized from ancient mythology to modern medicine. In Greek mythology, Mnemosyne (*memory*) was the mother of the nine muses: Klio (*history*), Melpomene (*tragedy*), Thalia (*comedy*), Kalliope (*heroic poems*), Urania (*astronomy*), Euterpe (*music*), Polyhymnia (song and oratory), Erato (*love and marriage*), and Terpsichore (*dance*). Those muses were the "media" of that time. However, Mnemosyne is still the mother (or grandmother?) of Teevee, Telephono, Multimedia, Internete (or whatever we decide to call our modern muses). Modern medicine recognizes Alzheimer's disease as a disorder of memory which destroys the very identity of the patient. Relatives of Alzheimer patients are horrified as they watch the person they have known and loved gradually disappear even though their bodies are still here.

No matter how sophisticated our media becomes, it is important to remember that it all rests on the foundation of Memory and Speech. It is merely an extension of the communication system created by nature. With the fourth generation of Multimedia and Internet, we have finally created a system in which the storage and the transmission of information is integrated within a single system. However, we are simply plagiarizing nature, which integrated the storage of information (Memory) with the transmission of information (Speech). The fact that Penfield found a memory centre near the speech centre suggests that Mother Nature has devised some ingenious integrated memory-and-speech system to provide us with our first generation of media to store and transmit information. We don't yet know how she does it. The search continues.

11.3 BIOLOGICAL BASIS OF SPEECH

Noam Chomsky argues that children learn to speak so effortlessly because they are born with a language acquisition device (LAD). The physiological structure corresponding to this hypothetical construct has not been identified. However the empirical evidence for such a device is so overwhelming that there must be some structure (or, more likely, some system of structures) which corresponds to this concept. Major candidates are two areas of the brain which have long been identified with speech - **Broca's area** and **Wernicke's area**, named in honor, respectively, of Paul Broca and Karl Wernicke who located those areas. They located them by finding consistent, distinctive speech aberrations in patients with damage to their respective areas. Broca found that his patients exhibited slow, labored, poorly articulated speech. Wernicke found that his patients exhibited fluid speech but it did not make any sense. Considerable research has identified Broca's area with syntactics (that is, the internal structure of language) and Wernicke's area with semantics {that is, with the external link of language to meaning) [ZURIF]. Those two areas are linked by a structure called the **arcuate fasciculus** and the cutting of this structure produces predictable linguistic disorders. Patients are unable to repeat what is said to them - incoming words to the Wernicke area cannot be passed on to the Broca area to be articulated. This whole system of structures is located in the temporal lobe on the left hemisphere of the brain (see Figure 11-2).

Maps of the brain showing the location of those various modules are superficially similar to the maps created by phrenologists (see Figure 11-3). People working in this domain are whimsically called the New Phrenologists. However, their new maps are dramatically different from those old maps. Phrenologists arbitrarily placed language below the eye, without any empirical justification for this quaint location; whereas New Phrenologists place language in the temporal lobe of the left hemisphere of the cerebral cortex because damage to this area result in deficiencies in language. Phrenologists based their placement of functions on reading bumps on the skull which have no logical relationship to any bumps in the brain below; whereas New Phrenologists directly explore the relationship between the functions and structures in the brain below.

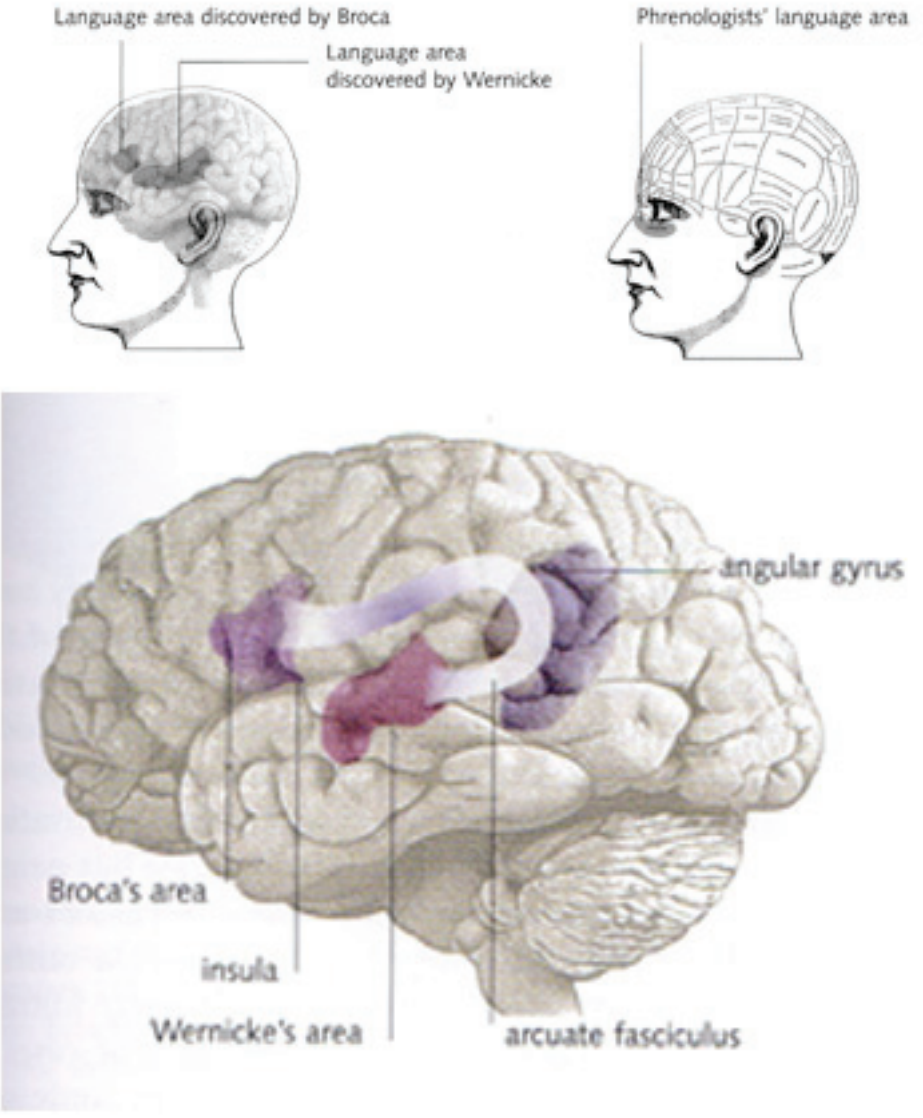


FIGURE 11-2 BIOLOGY OF SPEECH

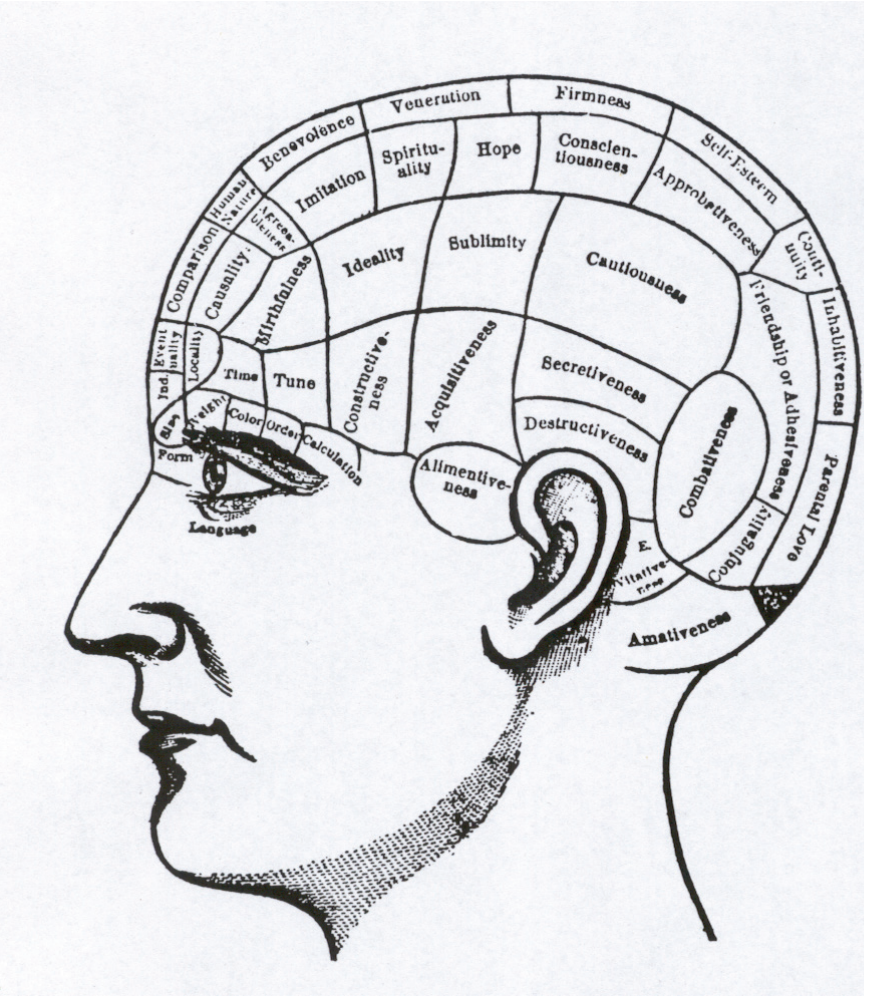


FIGURE 11-3 PHRENOLOGY CHART

Phrenologists had no theoretical framework to tie together their set of categories; whereas the New Phrenologists are guided by the theory of evolution. It is no surprise then that there is an area devoted to such a precise function as recognition of faces. Social animals need to know who's friend and who's foe. It is no surprise, in reading a newspaper this morning, to find that trust is related to the secretion of a particular chemical - the oxytocin hormone is the biological basis of trust [FREEZE]. Social animals need to trust one another. It is no surprise on reading my newspaper ANY day to find that it is full of gossip. Social animals need gossip in order to get rid of members of the group who are not trustworthy. Thus

evolutionary psychology provides a framework for understanding which modules can be expected to be found in the brain.

Since the first generation of media – Memory and Speech – comes to us compliments of the process of biological evolution, they must be represented somewhere in the nervous system. However, the second, third, and fourth generations come to us compliments of cultural evolution. Though the content of what we acquire from our culture must be somehow represented in the nervous system, there is no reason to assume that the tools for storing and transmitting this content have any biological basis.

That is perhaps why the biological basis of **dyslexia** was not considered, and thus discovered, until recently. One version of dyslexia is caused by a missing link between Broca's area and Wernicke's area and thus the dyslexic can't understand and articulate language at the same time. That is why William Calvin was so surprised when he found that his father could no longer read as a result of a stroke [CALVIN]. Surely the stroke had not damaged a Read Centre as strokes had damaged the Speech Centers of the patients of Broca and Wernicke? There is indeed not a Read Centre as such. However, since writing and reading in the second generation of media piggybacks on speaking and listening of the first generation, those activities require an intact speech centre - plus links to the visual cortex for reading and to the motor cortex for writing (see Figure 11-4). The stroke suffered by the father of William Calvin had severed that link with the visual cortex. The **angular gyrus** serves as a link between visual word recognition and the rest of the language system.

In Section 10.3, we considered the argument that we are *Natural-Born Cyborgs* [CLARK]. Andy Clark suggests that the various media tools which we master are represented in our brains. Those young people who have been raised on video- and computer-based media are biologically different from those of us raised on speaking and reading. Recent evidence that the frontal lobes are not fully formed until after adolescence lends credence to this theory. Our brains are plastic enough to accommodate those various generations of media. Thus, we acquire the extrasomatic tools of the second, third, and fourth generations of media from our culture but they become part of the system into which subsequent content is assimilated. We learn to read and then we read to learn. Do we have essentially the same brain as our hunter-gatherer ancestors with extensions or do we have different brains because those extensions are assimilated? Do our children have different brains from us because they are assimilating different extensions?

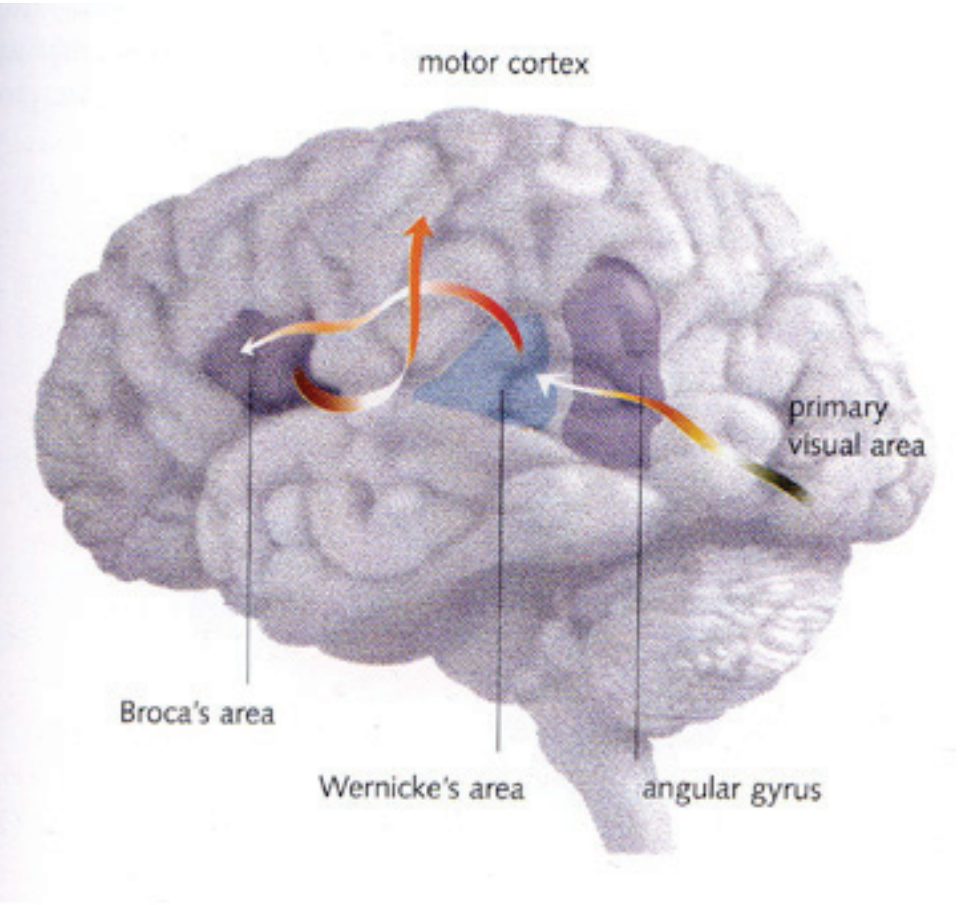


FIGURE 11-4 BIOLOGY OF READING/WRITING

11.4 MANUAL FOR FIRST GENERATION

We don't need to understand the internal combustion engine to drive a car. Most of us learn to drive by driving. We are rarely concerned, except when something goes wrong, with what's happening under the hood. However, knowing what's happening can be helpful. When learning to drive a standard-shift car, I often stalled by letting the clutch out too quickly - this can be a problem since I was learning in San Francisco. A friend explained how releasing the clutch put a moving plate and a stationary plate in contact, so that the moving plate started the stationary plate in motion. If they are brought together too suddenly, the stationary plate stopped the moving plate. With this image in mind, I never stalled again.

Now that we've started looking under the hood of the brain, we can perhaps learn how to improve our memory and speech. There have always been manuals to help us improve memory and speech based on experience. Rita Carter followed a brilliant scholarly book - *Mapping the Mind* - summarizing research on the brain [CARTER 1998] with another book - *Mapping the Memory* - suggesting how, as the subtitle indicates, understanding your brain can improve your memory [CARTER 2006]. Here is a manual for the first generation of media, based on such research.

- *Repeat anything you want to remember.*

We are introduced to a number of people at a cocktail party and later bump into one of those people to whom we were introduced. "*Sorry, I don't remember your name*". You don't remember it because you never "*membered*" it in the first place. You haven't forgotten it - you never learned it. To learn it, you have to focus attention on it and repeat it to help your hippocampus shift it from short-term to long-term memory.

- *Use action to recall arbitrary information.*

Remembering an arbitrary code can be enhanced by associating it with some action. This remembering the code for your bicycle lock becomes more like riding your bicycle. I once panicked when I imagined that I had forgotten my code for the ATM. When I got to the ATM, I found that I had punched in the code without thinking about it. My fingers remembered it.

- *Use stories to remember semantic information.*

Semantic information emerges out of episodic memory as the context in which you learned it fades away. This makes it vulnerable since the hooks have gone. You can reverse this process by creating a story around the

semantic information. Mnemonics like "*Thirty days has September* --" are familiar short stories. Longer stories were recommended by early memory experts who suggested that you take a virtual stroll through a familiar setting and place the things you want to remember along the way.

- *Focus on the hierarchy underlying the sequence in remembering a speech.*

A student once asked me how I could deliver a three-hour lecture without looking at notes. I pointed out that it only seemed impressive when the focus is on the sequence of thousands of words in the lecture. However, when you look at the hierarchy of thought underlying the sequence of language, you realize that I am remembering only a few distinctions. For example, in the lecture corresponding to this chapter, I am starting with a few words about levels of analysis, looking at the biology of memory, then biology of speech, and finally providing a manual for the first generation of media. In the second section, I am looking in turn at various dichotomies in memory - short-term and long term, procedural and semantic, episodic and semantic, and then pointing out that the old brain is involved in all those types of memory.

- *Subcontract out many memory tasks to the second, third, and fourth generations of media.*

If I can't remember a few dichotomies in giving a lecture, as described above, I throw up an outline from a PowerPoint presentation on a screen, ostensibly to remind the audience where they are at, where they have been, and where they are going, but actually to remind myself. PowerPoint slides can be used as electronic cue cards. My partner, Siliclone at www.siliclone.com, contains my various publications so that Scot need not store the clutter of content. Lists of books I have read and videos I have seen are in a FileMaker database on my computer, so that I can stay listless. Searching that database rather than my mind yields many more hits - much more can be recognized than recalled. If you were asked to *recall* other members of your Grade 1 class, you may come up with only a few names. However, if you were shown a group photograph of your Grade 1 class, you would *recognize* many more.

I started writing an operating manual for species homo sapiens in the 1960s. Much of it was about reducing the noise from the central nervous system through meditation and increasing the signal from the autonomic nervous system through biofeedback, in order to listen to the very local news from your body. After 20 years in media studies, most of my operating manual is about acquiring the skills of the four generations of media. However, it is biased towards the second, third, and

fourth generations. Since the first generation is the conception-day gift, we assume that we know how to use it *naturally*. However, we still need help unwrapping the gift.

CHAPTER 12
SOCIOLOGY –
THE LEVEL ABOVE

12.1 FROM GENETICS TO MEMETICS

12.2 THE PERSON IN SOCIETY

12.3 APPLIED MEMETICS

We have the power to defy the selfish genes of our birth and, if necessary, the selfish memes of our indoctrination. We can even discuss ways of deliberately cultivating and nurturing pure, disinterested altruism - something that has no place in nature, something that has never existed before in the whole history of the world. We are built as gene machines and cultured as meme machines, but we have the power to turn against our creators. We, alone on earth, can rebel against the tyranny of selfish replicators.

Richard Dawkins
The Selfish Gene, Page 215

12.1 FROM GENETICS TO MEMETICS

In the previous chapter, I described how Edward O. Wilson annoyed both biologists and sociologists, by inventing a discipline called sociobiology, using biological terms to discuss sociological phenomena [WILSON 1975]. Psychologists, who felt by-passed by a synthesis of the level below and the level above, were even more annoyed. Distinguished psychologists formed anti-Wilson organizations and even doused Wilson with water at an academic conference. However, since then, psychologists have accepted many of the principles expounded by Wilson, but have transformed **sociobiology** into **evolutionary psychology**. This discipline holds the best hope for a synthesis of psychology with the level below, biology, and the level above, sociology.

Wilson had already earned a Pulitzer Prize for his work on ants. Some of the criticism was based on the mistaken perception that he was viewing us as ants and our society as an ant hill. We are, indeed, social animals, like ants. However, our various roles are not as constrained by genetics as those of ants. Merlin Donald phrases the difference whimsically when he describes the Big Bang of the Brain as the "*Great Hominid Escape from the Nervous System*" [DONALD, Page 149]. Each of our nervous systems is linked to those of the other members of our social group. This super-organic system is held together by language, that tool we acquired during that Big Bang of the Brain.

Language permits us to share information so that each of us need not acquire all our information on our own. Isaac Newton said he could see so far only because he stood on the shoulders of giants. We can see even further by standing on the shoulders of Newton. A High School student can learn what Newton learned from a life-time of diligent research in a semester. We don't all have to invent the various wheels built by our creative ancestors.

Thus, cultural studies is important in the study of our species (*other animals ain't got no culture*). However, culture makes sense only in the context of biology. We can't assume that culture replaces biology (*humans ain't got no biology*). Cultural evolution piggy-backs on biological evolution. To study culture without biology is like trying to understand the pattern of flotsam and jetsam on a beach without considering the sea. The outside-in influence of culture is powerfully constrained by the inside-out unfolding of biology.

One evolutionary psychologist has destroyed the Standard Social Science Model (SSSM), based on the idea that the mind is a blank slate (tabula rasa) on which culture writes [PINKER 2002]. This "tabula" is far from "rasa" - the human mind has been built up by genes over hundreds of thousands of years of survival in a harsh arena. Another evolutionary psychologist has suggested an alternative model for the social sciences. In *The Selfish Gene*, Richard Dawkins proposed that cultural evolution could be considered as a sequel to biological evolution, in which genes are replaced by **memes** - ideas which are passed on from person to person through imitation [DAWKINS]. The evolution of body is controlled by genes; the evolution of mind is controlled by memes. Susan Blackmore developed this idea in a book which could well be called *The Selfish Meme* [BLACKMORE].

The science of **memetics** (study of memes by analogy with genetics, the study of genes) is now well-established. There has been an international conference - *Cambridge Meme Conference* at Cambridge University in June 1999 - out of which emerged a book - *Darwinizing Culture: The Status of Memetics as a Science* [AUNGER 2000]. Robert Aunger, who convened the conference, has raised its status considerably by documenting the probable biological basis of such memes [AUNGER 2002]. There is a scholarly journal - *Journal of Memetics* - whose subtitle *Evolutionary Theories of Information Transmission* clearly places Memetics within the domain of evolutionary theory.

Scholars from other disciplines have explored Memetics from their various diverse points of view - Richard Brodie, a businessman, provides a popular introduction to memetics, entitled *Virus of the Mind: The New Science of the Mind* [BRODIE], Douglas Hofstadter, a mathematician, offers tips on how to best pass on memes [HOFSTADTER], Douglas Rushkoff, in *Media Virus,* exposes how media spreads self-serving memes [RUSHKOFF], and Mihali Cziksentmihalya, a psychologist, suggests how we can escape the tyranny of genes and memes [CZIKSENTMIHALYA].[1]

"*Meme*" is hardly less vague than the almost-synonyms "*idea*" and "*concept*" (however, if it were precise, it would not accurately map on to the important but imprecise domain of cultural studies). The advantage is that it provides a rich analogy with the gene. We can plagiarize the precise

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[1] The meme meme is alive and well. When googled, "meme" got 84, 700, 000 hits as opposed to a mere 15, 200, 000 for its ancestor "gene".

language of nature to describe the vague domain of culture. We can check how gene does it and see how meme may do it. The meme-as-gene metaphor permits us to enlist the powerful theory of evolution in our difficult project of understanding social phenomena.

The analogy between the gene and the meme is based on the argument that they are both replicators - that is, they are both systems whose sole purpose is to copy themselves. According to Dawkins, good replicators have **fidelity** (they copy accurately), **fecundity** (they make many copies) and **longevity** (the copies last a long time). Replicators produce interactors - genes produce organisms, memes produce minds.

Previously, I presented the history of media as a sequel to the theory of evolution [GARDINER 2002]. Genes are the replicators underlying the theory of evolution. However, we need a second system of replicators, memes, to explain the sequel. The theory of evolution explains only how we acquired Memory to store information and Speech to transmit information. The history of media is the story of how we extended our nervous system by storing and transmitting information outside our bodies to deal with an increasingly complex society. Those extrasomatic tools increased the fidelity, fecundity, and longevity of memes.

Memes, like genes, may replicate themselves as they are passed from person to person. If a meme is worth sharing, it is also worth keeping. Perhaps the sharing of memes is a copy-and-paste rather than a cut-and-paste operation. Perhaps multiple copies of the meme at source may reflect the number of times the meme is passed on and thus represent the importance of the meme. Evolution explains how complexity can emerge out of simplicity. However, biological evolution can not explain the creation of the most complex system, the human brain. That requires a second system of replicators - we must go beyond genes to memes. This level of complexity requires the accumulation of "*information not instructed by the genes, but selected from the environment*." [AUNGER 2002, Page 187].

The gene-meme analogy, like all analogies, is useful because it enlightens us about both systems being compared. However, the analogy breaks down. The fact that it breaks down makes it more rather than less useful, since it highlights the essential differences between the two systems. One difference is that the meme depends on the gene whereas the gene does not depend on the meme. That is, meme-based cultural evolution piggy-backs on gene-based biological evolution. That is why the Standard Social Science Model was inadequate.

A second difference is that the gene operates at the biological level of analysis and the meme at the sociological level of analysis. As we move up the hierarchy of levels, new phenomena emerge. We tend to refer to them as epi-phenomena, but they are phenomena nevertheless. Thus, memes are not reducible to genes. That is why the original thesis of sociobiology was inadequate.

A third difference is that your genes come from two parents, whereas your memes may come from one to many "parents". Thus, whereas you can't "choose" between the blue eyes of your mother and the brown eyes of your father (that is pre-determined) nor can you compromise between the two colors, you can choose from among the memes passed along from their various parents, and can reach some compromise position on any issue. Whereas genetic transmission is always vertical (parent to child), memetic transmission can also be horizontal (adult to adult, child to child), and can even reverse vertical transmission (child to parent). In our modern world, with its emphasis on horizontal transmission, memes become independent of genes, and may produce inaccurate explanations, addictive habits, and malicious gossip.

Various metaphors of the relationship between the gene and the meme have been proposed - gene is to body as meme is to mind, gene is to hardware as meme is to software, gene builds the stage and meme writes the play. All of those metaphors imply that genes and memes are complementary. None capture the fact that there can be conflict between the gene and the meme. Memes underlying celibacy and homosexuality, martyrdom and suicide obviously do not contribute to the survival of a species. However memes are concerned with the survival not of our species but the survival of their species.

12.2 THE PERSON IN SOCIETY

Psychology is too often the study of the person as if the person is not a part of society. Sociology is too often the study of society as if it does not consist of people. When I went to graduate school, therefore, I

decided to study social psychology – that is, the study of the person in society.[2]

Alas, I wrote a doctoral thesis on deductive reasoning and thus fell into the traditional trap of studying the brain as if it acted in isolation. Earlier, I spoke about **tabula rasa**, the assumption that the brain is empty and is filled in from the outside by culture. A second error in traditional psychology has been **tabula isola**, the assumption that the brain acts in isolation. Sociologists have been making the opposite error, that is, the assumption that society can be studied as if it wasn't composed of people. The study of genes alone considers the person as if not a member of society; the study of memes alone considers society as if not composed of persons; only the study of genes-and-memes captures the person in society.

The models of communication presented in Chapters 2, 3, and 4 evolve from the behavioristic model, involving only input information, to the humanistic model, involving input and stored information, to the interactionist model, involving input, stored, and fedback information. However, all three models are mechanistic. The TOTE unit of the interactionist is, after all, inspired by the computer. The gene-meme analogy provides an organismic model. This model describes a culture as a network of people who can communicate with one another, because they share a system of memes.

This group can vary in size from our species as a whole to the small, intimate society of the family. Genetic studies have demonstrated that we are all one family, which spread out throughout our planet from East Africa over the last 60,000 or so years. Each of us can find out where we fit in this family by sending our DNA to the Genographic Project, conducted by National Geographic [WELLS S]. Men can trace the route out of Africa through the Y chromosome, which is passed on unchanged from father to son, and women can trace their route through mitachondrial DNA, which is passed on unchanged from mother to daughter [SYKES]. Communion within a species which shares genes is a firm foundation for communication within a world culture through shared memes piggy-backed on

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[2] The only social psychologist I knew was Wallace Lambert at McGill University. I asked him which were the best universities to study social psychology. He said "*University of Minnesota, University of Illinois, and my brother is at Cornell*." "*I didn't know you had a brother*." "*Yes, William Lambert.*". "*My name is William Lambert Gardiner and I believe in omens.*" Four years later, after being quizzed for three hours by six prominent psychologists about my thesis, William Lambert said to William Lambert Gardiner "*Here's your Ph. D. – now go out and learn something and don't embarrass me! "*

those shared genes. The World-Wide Web holds out the prospect of a superorganism [STOCK] or a global brain [RUSSELL]. Such "memes" are moving out of fiction into science.

The small society of the family is where we learn how to behave within the various cultures we move on to share with larger groups. Society begins at home. For example, trust, which is essential among social animals like ourselves, is initially learned in the family. Breakdown of the family is contributing to the crisis of trust. John Burnside, the Scottish poet, tells a story of his father inviting him to jump from a table into his arms, stepping back and letting him fall, saying "*Dinna trust naebody*" [BURNSIDE]. His father was obviously unclear on the concept of establishing trust within the family! Trust is tarnished every time a father fails to turn up as promised for a baseball game because he is too busy at work, and severely damaged when a divorced parent disappears entirely from the life of a child.

This does not necessarily mean that you should trust your parents even when they prove to be trustworthy. They (usually) have our best interests at heart. However, they are not always objective. If your mother thinks you are a great artist and your father that you are a great scientist, you may want to get a third opinion. Do you trust business people, lawyers, doctors, mass media, news announcers? Recent examples of corruption in business, in media, and even in clergy may make us hesitate.

This issue of trust is important in the psychology of communication. Communication settings could be classified by considering that both source and destination can be many or one. Within the resultant matrix (see Figure 13-1), three of those settings are found within the university - one-to-many (lecture), many-to-many (seminar), and one-to-one (tutorial). The missing setting, many-to-one, is the real-life situation of the student. S/he is inundated with information, often contradictory, from parents and friends, teachers and class-mates, authors and announcers. From time to time, some one may alert you to the need for good bullshit detectors or bummer-meters or whatever. Little attention is given to how to identify bullshit or, at a loftier level, who should we trust. Which sources should be trusted?

As argued above, we are social animals and thus trust is very important. Without trust, society will fall apart. Recent cases of corruption in business, government, and even religion have created a crisis of trust.

Science is one of the few institutions that has retained trust.[3] The science meme differs from ideological memes in containing the seeds of its own destruction. Hypotheses are designed to be *dis*-proven. Beautiful big theories can be destroyed by ugly little facts. Theory is constantly tested against reality. The meme, like the gene, will not survive if it does not "fit" its environment. Science can be seen as a competitive struggle between rival hypotheses in which only the "fittest" (i.e. which best fit the facts) survive.

The post-modern critics who have infiltrated the academy are nibbling away at this trust from the inside. They argue, for example, that science is just an ideology which merits no more status than any other ideology. They even criticize the meme of reality. However, the reality of an objective world out there is a hypothesis which has so far not been *dis*-proven, despite many empirical tests from Bishop Berkeley kicking a stone and getting feedback from reality to NASA sending astronauts to the moon and bringing them back alive.

The emphasis in evolutionary psychology on the social animal does not imply that we are never anti-social. In *Opening Skinner's Box*, Lauren Slater surveys the great psychological experiments of the twentieth century [SLATER]. Among those experiments were those by Stanley Milgram [MILGRAM] on obedience and Philip Zimbardo [ZIMBARDO] on simulated prison. Those experiments reveal that our species is very obedient to authority and very brutal if put in a position of authority. Slater points out that controls on psychological research would not permit such experiments to be conducted today.

Such ethical constraints on research are very important. However, one can not help suspecting that we are once again seeing a reluctance to accept the dark side of human nature. The innocuous questionnaire studies now permitted on such issues of authority would reveal only our comforting illusions about ourselves. What is now applauded is studies which reveal that violence is caused by television – thus allowing us to use a scapegoat for our shortcomings. How did we manage to have two world wars without television? In presenting us as a social animal, we should, with our emphasis on "social", not forget the "animal" which continues to fight for survival.

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[3] Bullshit-detector alert - I am a member of this institution and not therefore objective on this issue.

When Francis Fukuyama wrote *The End of History and the Last Man*, he was essentially gloating about the victory of capitalism over socialism, when the Soviet Empire crumbled [FUKUYAMA]. He failed to mention that it was a Pyrrhic victory. Capitalism is based on greed and envy, whereas socialism is based on sharing and empathy. It is a sad reflection on human nature, therefore, that capitalism triumphed over socialism. Socialism failed because it assumes a more benign concept of human nature or simply ignored human nature altogether. We resist allegiance to any group larger than the family or the tribe, which is essentially a much-extended family. "Nations" like Yugoslavia and Iraq, cobbled together by the Treaty of Versailles without any respect for tribal rivalries, fell apart as soon as a strong central authority was removed. We want to own property rather than share it.

The social nature of our species is well illustrated by our latest technological extension of the nervous system, the internet. E-mail is, by far, the most popular on-line activity. People flock to the Internet as a meeting-place. A project conducted at GAMMA with a primitive version of the Internet – the Canadian videotext system – was entitled Agora 2. The original Agora, in ancient Athens at the foot of the Acropolis, was a market-place which became a meeting-place for Socrates and his students. This modern Agora is a meeting-place which is becoming, to the dismay of many of its residents, a market-place. A fine summary of *The Psychology of the Internet* [WALLACE] is largely about the SOCIAL Psychology of the Internet.

Edward O. Wilson continues his campaign to integrate the sciences in his more recent book *Consilience: The Unity of Science* [WILSON 1998]. The big gap is between the natural sciences (biology) and the social sciences (sociology), with psychology walking a tightrope between the two. Pat Duffy Hutcheon attributes the difficulty to the dualistic tradition in Western philosophy. Thus a distinction between the body and the mind permits us to consider body as part of natural science and mind as beyond the scope of science in the domain of philosophy and religion [HUTCHEON]. She traces a parallel and under-heralded alternative tradition of monism. This tradition permits a smooth flow from natural to social science.

Wilson teamed up with Charles Lumsden to develop a theory of gene-culture co-evolution [LUMSDEN & WILSON]. They invented the concept of "culturgen" as the basic unit of inheritance in cultural evolution to emphasize that nothing is purely genetically determined or purely environmentally determined. However, they argued that "*the genes hold*

culture on a leash". Susan Blackmore disagrees [BLACKMORE]. Once genes have provided an environment for memes - the human brain, memes pushed for a bigger brain. This is no necessarily a good thing for the gene - a big brain is dangerous (mother in danger of dying in childbirth), it is inconvenient (child must be born prematurely), and it is expensive to maintain. Memetic pressure helps explain why we have much more brain than we really need merely to survive. Memes invade a brain and turn it into a mind.

Titles like *Virus of the Mind* and *Media Virus* mentioned above, use the meme-as-germ metaphor. We infect one another with viruses and parasites and must boost our immune system or disinfect ourselves with vaccines.[4] This medical metaphor is useful to puncture our pomposity as we realize that we are mere vehicles for the propagation of selfish genes and memes. As a teacher, however, I prefer not to think of my career as spreading epidemics, with any original idea I may have created being merely evidence that I have started an epidemic of my own. Though I resist the gene-as-virus metaphor, I find myself tempted to use it in a certain situation. The person who had most influence on my scholarly career was J. J. Gibson, although I never understood what he was talking about. However, he was very excited about something (whatever it was) and I wanted to share that excitement. You could say that his enthusiasm was infectious.

The passing of a meme from mind to mind is usually attributed to imitation. The Oxford English Dictionary defines meme as "*an element of a culture that may be considered to be passed on by non-genetic means, esp. imitation*". Indeed, in a hunter-gatherer society, imitation is the major mechanism. Boys went hunting with their fathers and girls went gathering with their mothers. By serving as apprentices to their parents, they acquired the skills or hunting and gathering. However, as we moved into the more complex agricultural, industrial, and information societies, imitation gave way to communication. The old consciously passed on their knowledge to the young through teaching rather than having the young unconsciously acquire their knowledge through imitation. It is teaching rather than learning that best distinguishes us from the other animals. Although there may be a residue of imitation, as in the case of the influence of J. J. Gibson on me, the transmission of memes is now largely by teaching or

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[4] This meme-as-germ metaphor sometimes goes a bit far. One reviewer of *The Tipping Point* [GLADWELL] describes the connectors, mavens, and salesmen who spread ideas throughout a culture, according to Malcolm Gladwell, as "*good sneezers of ideas*".

teaching oneself (that is, learning). Further memes must be created before they can be imitated. Thus, innovation as well as imitation must play a role in memetics.

12.3 APPLIED MEMETICS

Advertising, public relations and other disciplines of persuasion could be considered as meme management. There are several selection criteria which determine how successful a particular meme would be. The more of these criteria a meme satisfies, the more likely it is that it will maintain and spread. They include: coherence, novelty, simplicity, individual utility, salience, expressivity, formality, infectiveness, conformism, collective utility [HEYLICHEN].

Let us focus on advertising, since it plays such a huge role in our modern environment. No one who shares in the wealth generated by our industrial society can complain about advertising per se. The wealth we enjoy has been created by the capitalist society and that society requires that we are aware of its products. It is thus entirely appropriate for a corporation to say "*Here it is - if you want it, come and get it*" and few would complain if they added "*You better hurry - it's going fast*." However, even boxing, which some view as even more brutal than advertising, has its rules. One of the Marquis of Queensbury rules of boxing is "*No hitting below the belt*". In the case of advertising, this means no hitting below that limen that divides conscious from unconscious motivation.

A cinema manager conducted an informal experiment in which he flashed "*drink Coke*" on the screen and noted a significant increase in the sale of Coke. No one in the audience reported seeing the message. This raised the prospect of subliminal advertising, Psychologists dismissed the experiment, pointing out that it was a hot Summer evening, the manager had turned off the air-conditioning, the movie was *Picnic*, and so on. Subsequent evidence of subliminal perception [PACKARD, KEY 1973, 1976] was dismissed by psychologists. However, in Section 7.5, we found that evolutionary psychologists are no longer dismissing the possibility of subliminal advertising.

Memetics provides another slant on this issue. Hotmail tagged the end of every e-mail message with a promotion for their new service. In 1997, Steve Jurvetson, a venture capitalist, coined the term "**viral marketing**" to describe this practice which has since spread throughout the internet [AUNGER 2002, Page 13]. The idea is not new. We used to call it word-of-mouth - viral marketing just speeds up the process using the internet in what has been whimsically called word-of-mouse. It is ironic that with all our extrasomatic devices of the second, third, and fourth generations of media, we find that the most powerful means of disseminating memes is the first generation of speech.

Viral marketing escaped the internet and moved from the virtual to the real world. One hot Summer day, I dropped into a bar and the bartender recommended a Vodka Ice. It was only later, when I heard that companies were paying people to push their product, that I thought that none of the many bartenders I have known had ever recommended a particular drink. Now that I had been alerted, I found myself suspicious of another customer recommending a particular drink. He could have been completely innocent, but I remember thinking that the world had become a nastier place when you can't even trust strangers you meet in a bar. Perhaps the corporate culture should be banned from contributing further to this climate of mistrust.

Media is viewed as a Fourth Estate serving as watchdog over the first three. Media Studies often views itself as a Fifth Estate, as a watchdog over the watchdog. There is no doubt that it bears watching. It has created a climate in which entertainment memes have triumphed over enlightenment memes. Media scholars point to the distortions of the subjective map of the objective world by media mediating between them. They are the long-sought "*weapons of mass distraction",* to use the phrase made famous by Michael Moore.

However, Media Studies should not focus entirely on decrying the entertainment emphasis but also contribute to the enlightenment emphasis. In an ideal world, in which all memes had equal opportunity in a free market of the mind, true memes would win. But the market of the mind is constrained by so many forces, which restrict the distribution of certain memes. Any meme which seems to challenge the inflated self-concept of our species has to fight much resistance to its spreading. However, truth (spelled with a small "t" so as not to upset pomo critics) is spreading, as we have accepted the theories of Copernicus, Darwin, and Freud. Perhaps we will in the future concede that we are captives of our genes and our memes.

CHAPTER 13 EPILOGUE

13.1 FROM COMMUNICATING TO TEACHING

13.2 FROM OVERLOAD TO COMPLEXITY

13.3 FROM OPERATING MANUAL TO CONCEPTION-DAY GIFT

13.4 FROM PERIPHERY TO CENTRE

The role of the school is no longer to organize the distribution of information but to teach students how to handle the information that is now common to all - in a word, to teach students to think and to utilize television, radio, reading, writing, any and all forms of communication, as tools in that process. Because we have an overload of information, the school's function is to help students sift through and make use of that flood of information that might otherwise overwhelm them. The role of the teacher should include teaching children how to structure and place in perspective information they already possess and are constantly absorbing. Very few teachers take this approach, and children have paid the price for their failure to do so by becoming uninterested in "school" learning.

Tony Schwartz,
Media: The Second God, Page 133

13.1 FROM COMMUNICATING TO TEACHING

Away back at the beginning of this book, I stated that I would tell you what I was going to tell you (Chapter 1 - Prologue), I would tell you (Chapters 2-12), and then tell you what I have told you (Chapter 13 - Epilogue). One way to summarize what I have told you in Chapters 2-12 is to focus down on teaching, a very important aspect of communication for me as teacher and you as student.

Chapters 2, 3, and 4 presented the behavioristic, humanistic, and interactionist concepts of the person as thesis, antithesis, and synthesis. Traditional teaching is based largely on the behavioristic concept of the person and thus embodies the corresponding transportation theory of communication. Information is transported from the source (teacher) to the destination (student). Educational reformers are arguing for a shift to the interactionist concept of the person with its corresponding transaction theory of communication. Teaching is a transaction between the teacher and the student, in which each responds to the fedback information from the other.

The first proposition of interactionism is that intrinsic motivation (the basic principle of humanism) is necessary to go beyond biological needs to the satisfaction of sociological and psychological needs. Extrinsic motivation (the basic principle of behaviorism) is not only ineffective in satisfying psychological needs but actually destroys the intrinsic motivation underlying knowing and understanding.

The second proposition of interactionism is that growing from the inside out is the primary process, supplemented by the secondary process of being conditioned from the outside in. The LAD (language acquisition device) leads but it needs the LASS (language acquisition support system). Thus, as teachers, we must respect the fact that the student is growing from the inside out and dovetail our outside-in instruction to that primary process. Hence the title of my forthcoming book - *Turning Teaching Inside-out* [GARDINER 2009].

The third proposition of interactionism is that there is a third factor beyond genetics and environment which determines human behavior - namely choice. This is further underlined in Chapter 5 (From Animal to Human) and Chapter 6 (From Child to Adult). Phylogenetic

and ontogenetic development are both the story of progressive emancipation from the tyranny of genetics and environment. Chapter 12 opens with a quotation from Richard Dawkins in which he encourages us to escape the tyranny of selfish genes and memes. One major focus of teaching is helping students make good choices.

The fourth proposition of interactionism is that the person has intrinsic worth. Thus, teachers should respect and enhance self-esteem. This worth is based on the fact that each of us, as members of our species, as a part of nature, plays an important role in fighting entropy by creating a full and accurate subjective map of the objective world. Teachers play their part by passing on their "understanding" to their students.

The fifth proposition of interactionism is that human relationships are basically intimate. We are all members of the same species on the same planet in essentially the same predicament. The so-called contractual relationships are mutual agreements not to realize the full potential intimacy. Since, in the contractual relationship, the people are interchangeable, the relationship between the teacher and the student is more intimate than contractual. That is, it is more like the relationship within families and among friends. Other professionals – doctors, lawyers, accountants, plumbers – have a more contractual relationship with their "clients". There is a commercial element in each of those relationships in which the professional has a vested interest. The teacher-student relationship is more intimate like that of the parent-child. It is not contaminated by commerce. Like parents, teachers must plan their obsolescence. Your plumber is not planning his obsolescence.

The only profession which comes close to teaching in this respect is the clergy. Ministers, priests, rabbis focus on the goals of their parishioners. However, this relationship is marred somewhat by the fact that their help is offered within the framework of a particular ideology. John Durham Peters makes this distinction concrete in comparing the teaching styles of two of our greatest teachers – Jesus and Socrates [PETERS]. Jesus broadcasts his message in the hope that it will be picked up and passed on by the members of his audience. Socrates has no message (he claims to know nothing and is merely serving as a midwife to pull out what the person he is addressing already knows - he turned teaching inside-out).

The teacher has no axioms to grind. POMO thinkers have argued that science is simply another ideology. However, it is open to feedback information from the objective world. The scientific meme, like the gene, will not survive unless it "fits" the environment. A beautiful big theory

can be destroyed by an ugly little fact. The process of scientific research is self-correcting. If a student is pursuing truth, then the teacher is the most reliable source. That is why horror stories about commercial drug companies influencing or even writing articles in scholarly journals, as described in *University, Inc: The Corporate Corruption of Higher Education* [WASHBURN] is so scary. This last source of reliable knowledge is threatened.

13.2 FROM OVERLOAD TO COMPLEXITY

The interactionist concept of the person and its corresponding transaction theory of communication is much better than the behavioristic concept of the person and its corresponding transportation theory of communication, as a model for teaching. However, it is still mechanistic. It considers the person, like the computer which inspired the model, as an information-processing system. In Chapters 5 (From Animal to Human) and Chapter 6 (From Child to Adult), the focus shifts from mechanism to organism, from physics to biology.

This is not rocket science. Rocket science is easy. It deals with the simple systems we have built ourselves during the last few years. Biology deals with the complex systems nature has evolved over millions of years. The complexity of biological systems is illustrated in Chapter 7 (From Behavior to Experience) and Chapter 8 (From Function to Malfunction). In the former, we learn that the nervous system is unique in being viewed from the inside (experience) as well as from the outside (behavior); in the latter, we learn that it is unique in having functional as well as structural disorders. Teachers must help students manage such complexity.

In any communication setting, the source may be one or many and the destination may be one or many. This yields the two-by-two matrix, depicted in Figure 13-1. Three of those communication settings – one-to-many (lecture), many-to-many (seminar), and one-to-one (tutorial) are emphasized in the university. However, the many-to-one setting is rarely considered. However, this is the setting which best describes the situation of the student. S/he is inundated by information (often contradictory) from various professors and media pundits, family members and friends.

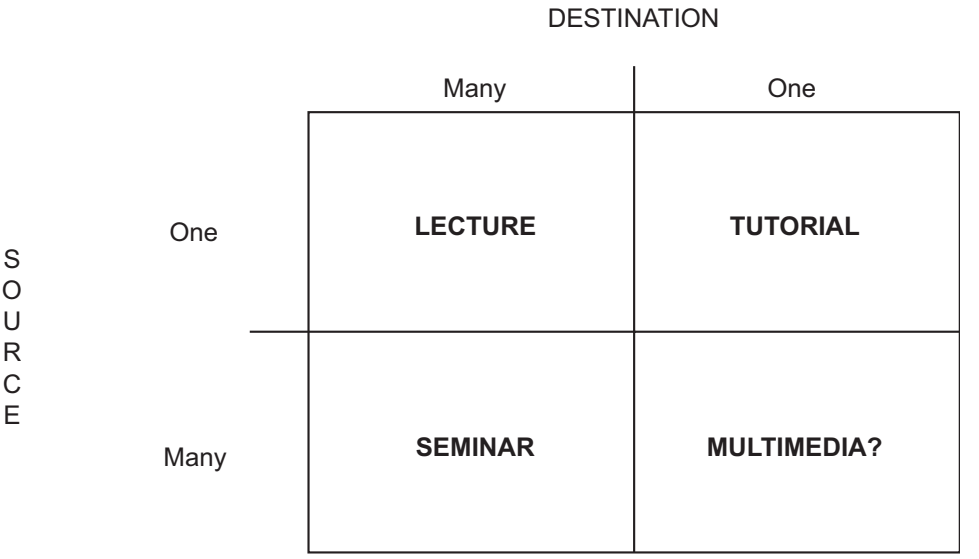

FIGURE 13-1 FOUR COMMUNICATION SETTINGS IN UNIVERSITY

This predicament is usually described as **information overload**, seen by some people as THE problem of our times. Whereas the industrial society, based on energy, experiences an energy crisis, the information society, based on information, experiences an information crisis. However, the energy crisis is that there is too little energy; whereas the information crisis is that there is too much information. As argued earlier, there is some evidence of a limitation in the rate of processing information. George Miller has compiled this evidence in his article *The magical number seven, plus or minus two: some limits on our capacity for processing information* [MILLER]. However, there is no evidence that anyone has reached the limit to the memory capacity of the human brain. The argument that senility is nature's way of of saying "disk full " is vitiated by the fact that it is the creative people (whose brains are fuller) who are most resistant to senility.

It may well be that the problem of information overload is a pseudo-problem; yet another illustration of our human capacity to turn solutions into problems. One consistent finding in years of research on intelligence is that intelligence is a function of the richness of the environment of the organism. Smart people grow up in enriched environments and stupid people in impoverished environment. The traditional outside-in teaching was appropriate in impoverished environments,

where the tell-'em-and-test-'em sessions with a teacher provided at least some enrichment. However, we now have incredibly rich environments which can help pull out the human potential.

We turn this solution of a rich environment into a problem of information overload. A magnificent smorgasbord of food is a problem only if you think you must eat it all. Perhaps, people raised within an outside-in educational system tend to think that they must assimilate everything in that rich smorgasbord of information in our modern environment. The inside-out teacher - whose concept of the person is of someone growing from the inside out rather than being conditioned from the outside in - welcomes the richness.

The information overload problem may perhaps best be rephrased as one of the management of complexity. Our information-rich modern environment permits us to build complex, subtle subjective maps of the objective world. The challenge is to organize the diverse information pouring in from the wide variety of sources into a coherent and comprehensive subjective map. It is not a quantitative matter of too much content but rather a qualitative matter of putting content into context. We must learn how to put data into context to yield information, information into context to yield knowledge, knowledge into context to yield understanding, and understanding into context to yield wisdom, as we move up that data-wisdom hierarchy, which is the means of adding value to the raw material of the information society.

For most people complexity is not a problem. They deal with it by simply refusing to assimilate any information which does not fit within whatever subjective map of the objective world they have settled for as satisfactory. The Jehovah Witness looks around nonplussed at all my books. He has one book which contains all the answers. The retiree (in body and in mind) has no need to learn anything more. He will devote his last few years to hitting a ball into a hole with a stick. The 'philosopher' in the local pub learns nothing because he already knows everything. His wife has returned the encyclopedia. The specialist in the university sacrifices breadth at the altar of depth. Complexity can perhaps be contained within a narrow domain. Much of the popularity of Ronald Reagan may be due to the fact that he was not so much the Great Communicator as the Great Simplifier.

In the 1980s, when information overload was considered as THE problem of the information society, Dr. Arthur Cordell of the Science Council of Canada asked me to think about it. *How hard should I think?*

$5,000. How long should I think? Eighteen months - I have to incorporate it into a report due 2 years from now. I thought about it and, fifteen months later, realized that it was a pseudo-problem. That was obviously not worth $5,000. However, I wrote the report on the real problem of the management of complexity which underlies the pseudo-problem of information overload. Access to all this information enables us to make a subtle and sophisticated subjective map of the objective world. Much of the focus of my subsequent career was on the management of complexity. Thank you, Arthur!

For those of us who still regard it as a problem, one constructive response to the challenge is to develop skills for managing complexity. We have already looked at a number of tools for the management of complexity. The Triad Model in Figure 3-2 helped organize vast amounts of information within an optimal seven categories. The Four Generations of Media model in Figure 10-1 helps organize information within the technosphere, once again within an optimal seven categories, and serves as a structure for this book. The siliclone in Figure 10-4 is a device for removing the clutter of content, which is often mistaken for complexity. It shifts the emphasis from recall to recognition, which is much easier. Idea processors and authoring languages in Figure 10-2 help us organize information in two dimensions of hierarchical structures and three dimensions of networks of interlinked nodes.

Some of the many early books on this issue - e.g. Alvin Toffler's warning about *Future Shock* [TOFFLER] and David Shenk's warning about *Data Smog* [SHENK] - are phrased in terms of information overload. However, more recent books - e.g. Kevin Kelly's warning about being *Out of Control* [KELLY] and Thomas Homer-Dixon's warning about being being faced with *The Ingenuity Gap* [HOMER-DIXON] - are phrased in terms of the management of complexity. Read those books to get a grasp of the problem.

All I am adding here is the argument that complexity has always been a feature of the objective world - what is new is the recognition that it must therefore become a feature of our subjective maps. Complexity was here in the ecosphere before we arrived. We have added to that complexity in the sociosphere and the technosphere and the super-complexity of the interactions among those three great spheres, and we have been arrogantly assuming that we can manage this complexity by extrapolations from our various "toys" in the technosphere. What is new is the recent recognition that we must turn from the mechanism to the organism as our model, from physics to biology as our basic discipline, from simple to

complex systems, from person-made mechanisms to nature-made organisms.

13.3 FROM OPERATING MANUAL TO CONCEPTION-DAY GIFT

Chapter 9 (Simulation and AI) and Chapter 10 (Mediation and IA) contrast the two strategies of using mechanisms to simulate natural intelligence and to augment natural intelligence. The best contribution of the former is to simulate environments so that students can learn in a situation where errors are not dangerous or costly, and where a simulated world is closer to the real world. The best contribution of the latter is that it suggests a curriculum for an alternative educational system.

In 1980, I published a book entitled *The Psychology of Teaching* [GARDINER 1980]. In that book, I described my ***Operating Manual for Species Homo Sapiens.*** Here was the argument. When I got my car, I got an operating manual; when I got my computer, I got an operating manual; when I got my brain (the most complex and mysterious system in the universe), there was no manual. I kept waiting for it - thinking it had been issued by another department and got lost by British Post. Halfway through my life, I realized that it was a do-it-yourself job. When all else fails, write the manual. So I wrote my own operating manual.

If you are reading this book, then you are no doubt a member of species homo sapiens You and I are members of the same species on the same planet in essentially the same predicament with basically the same equipment. A brain is a brain is a brain. Thus, my operating manual is your operating manual. The difference between Margaret Mead and Albert Einstein (or whoever you think has most fully realized the human potential) and you and I is that they acquired a better operating manual. Education can best be considered as acquiring the Operating Manual for Species Homo Sapiens.

The operating manual for species homo sapiens that I wrote then was essentially an operating manual for the nervous system (the only subsystem which can be "operated" directly). It contained sections on biofeedback to enhance the signal from the autonomic nervous system and on

meditation to reduce the noise from the central nervous system so that I could listen to the very local news from my body. In the interval, after over 20 years in communication studies, I have realized that such "*intra*personal communication" is an important but minor aspect of communication.[1] This focus on the single brain assumes that the mind is not only empty (tabula rasa) but isolated (tabula isola).

My emphasis has shifted to *inter*personal communication. All members of our species acquired a means of storing information (memory) and a means of transmitting information (speech) as part of the conception-day gift. As argued in Chapter 10, this first generation of media (Memory and Speech) has been supplemented over historical time by a second generation in which information is stored outside the body (Print and Film), a third generation in which information is transmitted outside the body (Telephone and Television), and a fourth generation in which information is both stored and transmitted outside the body (Multimedia and Internet). Much of the operating manual should be about acquiring the tools and skills of those four generations of media.

Education could be considered as a recapitulation of the history of our species. Thus, in this high-speed re-run, the student would acquire the skills and tools of those four generations of media. Those could be classified as the explaining skills when the student is source and the understanding skills when the student is destination. The explaining skills would include certain techniques for organizing information at the source for effective transmission (let us call them **heuristics**) and the understanding skills would include certain techniques for organizing information at the destination for effective reception (let us call them **mnemonics**).[2] This "curriculum" is summarized in Figure 13-2.

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[1] However, let us not be so distracted by those flashy media which bring news from the outer world that we neglect, in practice and in theory, the news from the inner world. Those media use the distance senses of vision and audition, which tend to overshadow the close senses of taste, smell, and touch.

[2] Bullshit-detection is one important aspect of mnemonics. Two books focus on this communication skill [FRANKFURT, PENNY].

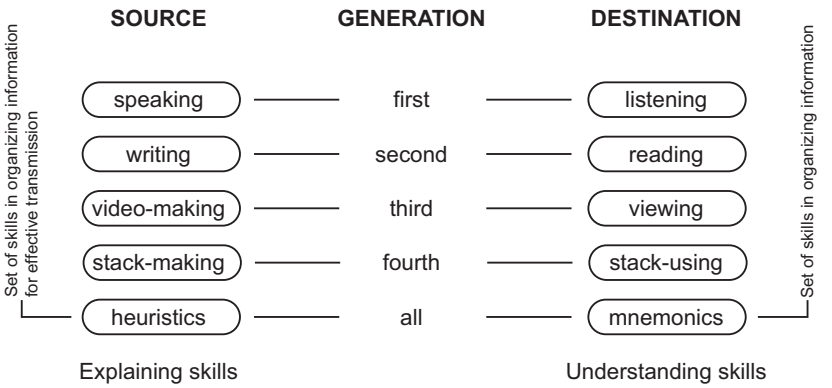

FIGURE 13-2
EXPLAINING AND UNDERSTANDING SKILLS

In Chapter 1, I described the empirical experiment I conducted on myself recording the time spent communicating. After 15 years of keeping such records, the most startling finding is the sheer amount of time spent communicating - typically over 70 hours a week, that is over 10 hours a day. Since most of my waking life involves the use of those four generations, that is what I should get good at. The only other activities which came close are the mundane maintenance matters of sleeping and eating. Those I have pretty well mastered.

The second most startling finding of this experiment is that I have never been tempted to assign any half-hour period (my basic unit of analysis) to thinking. Rather than "think" of myself as a scholar who never thinks, I prefer to believe that I am thinking all the time but there is always some correlated communication process accompanying "thinking". The isolated brain is quite inept. I can multiply two one-digit numbers "in my head" only because I have memorized the multiplication tables. When I have to multiply two two-digit numbers, I reach for pencil and paper.[3]

Science fiction has been a useful complement to science fact in considering the future. Unlike scholars, scifi writers are not reluctant to speculate about the future. They provide a "preview of coming attractions". Donald Kingsbury, who resigned from the Mathematics Department at McGill University to write science fiction, provides a vision of the

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[3] Albert Einstein once said that his pencil was smarter than he was. Andy Clark, author of *Natural-Born Cyborgs* [CLARK], experienced the loss of his laptop computer as an amputation.

cyborg of the far future, which goes way beyond the current visions presented in a previous chapter, in his scifi novel, *The Psychohistorical Crisis* [KINGSBURY].

The novel has an unhappy beginning. The hero - Eron Osa - is executed. It turns out however that being "executed" in this far-in-the-future universe means having one's "fam" (an electronic extension of one's self) detached and destroyed. Life in this future has become so complex that "famlessness" is death. There is no way that one can survive as one travels between planets, without this device which enables one to quickly acquire the diverse languages and cultures of each planet. We have evolved to be quick studies of novel environments. However, our environments in this future have become so novel and so numerous that biological evolution must be supplemented by technological innovation. The rest of the novel is about how our famless hero manages nevertheless to survive and even thrive. He survives because he re-discovers the long-lost qualities of the "naked brain" and he thrives because he thus has a firmer foundation for his new fam than his opponents who have lost touch with their un-augmented brain.

The fam is a tool which is worn rather than carried or implanted. It continues the progression, due to miniaturization, from floor-top to desk-top to lap-top to palm-top to wrist-top to brain-top. Fams combine the functions of various current tools - PVR (which can be set at accelerated assimilation), fax machine, copier, sleeping pill, alarm clock, telescope (eye-fam set at high magnification) - and various people - therapist, tutor, research assistant, Girl Friday and secretary. One very important function is to annotate and edit the environment. To survive and thrive in the complex world of the future, not only must you be augmented but your environment must be annotated. We get an early glimpse of such devices built into the dashboards of cars. Equipped with a global positioning system (GPS), your car knows where it is, where you may want to go (the nearest Holiday Inn, MacDonald's restaurant, etc.,) and how you can get from here to there. The fam is potentially in touch with many external information-processing devices in an information-rich environment. It can of course communicate directly with the fams of other people through "fam-to-fam links". There are also "archival consoles", "map-readers", "weasels" (like the owls in Harry Potter), "fonepads", "sim overlays", "wall emitters", "holo illustrators", and "mnemonifier", all of which can feed the fam.

The necessity which is the mother of the invention of the fam is the management of complexity. Government is by psychohistorians who can

predict the future because they (aided by their fams) can manage the complexity generated by the many variables which determine the future. Much apparent complexity is actually just clutter which the fam can filter out to avoid chaos. The fam is also capable of "complexity compression". Since the naked brain is stupefied by complexity, it must subcontract out various functions to the fam.

The organic brain and the fam have a symbiotic relationship, with the fam being subservient to the organic brain. One wonderful metaphor for this relationship is of a legless person in the knapsack on the back of an armless person. Brain and fam can be de-coupled and re-coupled without losing personality but brain is helpless in dealing with the complex environment on its own. The unaugmented organic brain is described as the "naked brain" , capable only of "monkey business". Amazement is expressed at the culture created by the famless Helmerians. The naked brain is however good for one thing - wild, primitive sex. There is some value too in disconnecting the fam from time to time to exercise your naked brain to keep it animal-sharp. Sensory and perceptual experience is richer.

This vision of a far-off future may help us better design our immediate future. Lo-tech and hi-tech futures are not necessarily either-or alternatives at the ends of a lo-to-hi-tech dimension. They may be creatively combined in a hi-tech hi-touch future. Since leaving my village in Scotland, I've gravitated to cities, because I'm an information junkie and cities are where the information is. Or, rather, cities WERE where the information WAS. With the fourth generation of media, I'm as central in the Smart Room of my electronic cottage in the village of Hudson as anyone in New York or London or Cupertino, California. The Global Village of Marshall McLuhan, where the center is everywhere and the periphery is nowhere, is finally here. So I'm back in a village where I know my neighbors rather than in an APARTment in a city. I can now greet every person I pass in the street. (My teeth were freezing during my first Winter in Montreal when I was trying to smile at everyone I passed.) Like the hero in Kingsbury's novel, I am exploring the optimal orchestration of the four generations of media. In our fascination with the plethora of extensions, we should not neglect the foundation on which they are built.

When I, as a teacher, ask myself - *What am I doing here?*, I used to answer that I am passing on the operating manual for species homo sapiens. After writing this book, I now prefer the less mechanistic metaphor of helping my students unwrap the conception-day gift. The first generation of media - Memory and Speech - is clearly part of the conception-day

gift. However, much of the gift comes wrapped with a message "*Do not open until* ---". the other generations of media piggy-back on this gift. Over historical time, brilliant members of our species have discovered much wisdom that is contained in this gift but must be unpacked. We do not need to re-discover the various wheels that have already been discovered. By passing on this wisdom, I help my students unpack the gift and see what footnote they can add to our accumulating human wisdom.

13.4 FROM PERIPHERY TO CENTRE

Media no doubt contributes to this complexity. However, it can also contribute to the management of complexity. The Big Story of the co-evolution of the person and media told here could be considered as the story of how our species extended our nervous systems to manage the increasing complexity as we moved from a hunter-gatherer to an agricultural to an industrial and now to an information society. The Toronto School of Media Studies falls within the intelligence amplification (IA) tradition of the history of computing. This whole IA tradition, documented brilliantly by Howard Rheingold, could be considered as the story of the management of complexity [RHEINGOLD]. Thierry Bardini documents the life of Douglas Englebart which has been devoted to the management of complexity [BARDINI]. His strategy is not the traditional one of simulating the organism with a mechanism - artificial intelligence (AI), but the alternative strategy of supplementing the organism with a mechanism - intelligence amplification (IA). The management of complexity requires the optimal orchestration of natural intelligence and artificial intelligence, the partnership of the organism and the mechanism.

The only sub-system which can be "operated" is, of course, the nervous system. That is where you live. That is why people talk to your eyes rather than your ears or your elbows - your pupil is the only place where your nervous system is exposed. Or consider the implications of a brain transplant. *Is it the recipient or the donor who survives?* Acquiring the manual is largely a matter of learning how to use tools (the word "acquiring" is judiciously chose to stress the fact that it is an inside-out job). As the wonderful genetic potential - given to all members of our species as a conception gift - unfolds, we reach out for tools which help us realize

this human potential. There are extragenetic tools (outside the genetic code) and there are extrasomatic tools (outside the body).

The computer is the latest, and most dramatic, extrasomatic tool. It extends the function of the brain as the telescope extends the function of the eye and the car extends the function of the leg. To refuse to use this tool is to try to outsee the telescope and to outrun the car. One very important set of tools is media. Indeed, education could be viewed as the process of using media to expand on our genetic information, or, in more conventional terms, of acquiring certain communication skills. As we have seen, media can be considered as falling within four generations, based on whether the storage and the transmission of information is extragenetic or extrasomatic.

Human progress has been a result of thinking outside the box of the brain using extragenetic and extrasomatic extensions of it. In advocating a curriculum centered on those tools of those four generations of media and the meta-tools of heuristics and mnemonics, I am paradoxically advocating a back-to-the-basics movement. The original basics were the three Rs – Reading, Riting, and Rithmetic (but apparently not spelling!). Those are the communication skills of the second generation of media. Rithmetic represents mathematics which is a language for more precise communication.

We have to add the first generation of media. Though it comes as part of the conception-day gift, it can be considerably refined by practice.[4] We must also add the skills of the third and fourth generations – video- and computer-based media. Rather than engage in futile debate about the relative merits of each of those four generations of media, we must aspire to an optimal orchestration of all four generations.

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[4] Indeed, any illusion of intelligence created by university-educated people is due to the fact that they have learned to listen well. (Listening is not on the official curriculum but students in the traditional university spend most of their time listening to lectures.) Harry Harlow came to Cornell University while I was a graduate student. In his nervousness about delivering an important series of lectures, he got drunk and missed an appointment to talk to the graduate students in psychology. He came around to our offices to apologize. One of my professors told me he was impressed by my intelligence. While he spoke to me and the three others students who shared my office, I didn't speak once. However, I listened very intently, since I was fascinated by his work and impressed by his apology to mere graduate students. If I had opened my mouth, I would have destroyed my reputation!

Another implication of this argument is that the discipline of Communication Studies should be more central in the academy. Currently, it tends to be precariously perched on the periphery. Whereas every university has a Department of Physics and a Department of English, only a few universities have a Department of Communication Studies. Even in those campuses, it tends to be low on the academic totem pole (*They get degrees for watching movies!*). At McGill University, the Department of Communication Studies had to merge with the Department of Art History in order to survive. At the University of Toronto, the *Centre for Technology and Culture* founded by the world's most famous Communication Studies professor, Marshall McLuhan, is constantly threatened with closure.

Part of the problem is that Communication Studies is a pre-paradigm discipline. That is, there is no broad framework, widely accepted by the scholars in the discipline, within which they work. The emergence of a fourth generation of media (Multimedia and Internet) introduces new issues into the discipline of Communication Studies, which make the old issues, published only a few decades ago, look quite quaint [JOURNAL OF COMMUNICATION]. The Ferment in the Field was a Tempest in a Teapot. The central issue could be whimsically reduced to the question of whether communication studies should be a branch of political science (critical studies) or of business administration (administrative studies).

The threat of dissolving into another discipline, which has always haunted the field, is now replaced by the opportunity to be the central discipline in the academy. This book aspires to provide a broad framework by fitting communication studies into perhaps the most widely-accepted paradigm of all - the theory of evolution. The history of media is the sequel to the theory of evolution. It explains how the nervous system has been extended by media to deal with the increasing complexity as we have moved from a hunter-gatherer to an agricultural to an industrial to an information society. The discipline of Communication Studies, redefined as Media Studies, is thus nothing less than the study of the unfolding of the human potential.

GLOSSARY

Concepts which may be unfamiliar to readers are written in **bold** in the text and included in this Glossary. They are listed in alphabetical order but defined in groups. "*No meme is an island*". Thus, for example, **sensorimotor stage**, **concrete operations stage**, and **formal operations stage** are defined under **stages of cognitive development**.

accommodation see **adaptation**

activation theory An emotion-arousing stimulus in the environment (negative goal) projects directly to the sensory reception area of the brain to provide the **cue function** and indirectly through the **amygdala** in the lower brain which acts diffusely on the brain to provide the **arousal function**. A psychological drive prepares the organism for appropriate action (fight, flight) by triggering the relevant physiological state (rage, fear).

adaptation Ontogenetic development (child to adult) has the same basic principle as phylogenetic development (animal to human) - adaptation to the environment. Adaptation involves the **assimilation** of information from the environment and the **accommodation**, if necessary, of the cognitive structure to this information (Jean Piaget)

amnesia see **defense mechanisms**

amygdala see **activation theory, hypothetical construct, lower brain**

anal stage see **personality development**

anaesthesia see **defense mechanisms**

angular gyrus The link between the area of the visual cortex responsible for word recognition and the areas of the temporal cortex responsible for language. A stroke victim with damage to this area may be unable to read.

antagonistic society A society in which the ends of the citizen and the ends of society are in conflict. c.f. **synergetic society**, in

which the ends of the citizen and the ends of the society are compatible (Ruth Benedict).

arcuate fasciculus see **Broca's area**

arousal function see **activation theory**

artificial intelligence (AI) The attempt to simulate various conceptual and perceptual functions of the human brain. c.f. **intelligence amplification** (IA). Using computers to supplement, rather than to simulate, natural intelligence.

assimilation see **adaptation**

Auto-phenomenology The inside subjective point of view, as opposed to **hetero-phenomenology**, the outside objective point of view (Daniel Dennett)

bit A basic unit in measurement of information. Information from the source is measured in terms of **uncertainty** at the destination. One bit of information is information that cuts uncertainty in half. see **Shannon-Weaver model of communication.**

bow-wow theory see **speech**

Broca's area Two areas of the brain have long been identified with speech - Broca's area (Paul Broca) and **Wernicke's area** (Karl Wernicke) named in honor of the scholars who located those areas. They have been identified roughly as the areas for syntax (creating sentences) and semantics (linking language to the environment) (Edgar Zurif). The two areas are connected by the **arcuate fasciculus.**

cannibal worms Worms fed on minced worms. The ones fed on worms which had previously learned a task took significantly less time to learn that task than worms fed on untrained worm, suggesting that the memory was stored at a chemical level. (James V. McConnell).

castration complex see **personality development**

cell assembly A neural circuit created when a nerve impulse passes over synapses often enough to create a permanent structure (Donald O. Hebb).

chain reflex see **classical conditioning**

circular reactions During the sensorimotor stage, stimulus and response get co-ordinated through a series of circular reactions. Between I and 4 months, you develop **primary circular reactions**. You happen to make the sound "ah" (response), you hear the sound (stimulus), you imitate the sound (response), you hear the sound again (stimulus), and so on as you imitate yourself over and over again. Between 4 and 8 months, you develop **secondary circular reactions**. You happen to make the sound "dah" while doting daddy is present (response), you see daddy jumping up and down with excitement at being recognized (stimulus), you repeat the sound (response), daddy jumps up and down some more (stimulus), and so on in that eternal process by which two generations continue to condition one another. Whereas your primary circular reaction was centered on yourself, this secondary circular reaction is centered on your environment. Between 12 and 18 months, you develop **tertiary circular reactions**. As before, you repeat a behaviour which has an interesting effect, but you vary that behaviour to discover what changes there will be in that effect. Thus, your babbling is not just "ah, ah, ah, ah, ah" as you imitate yourself in the primary circular reaction, nor just "dah, dah, dah, dah, dah" as you perpetuate an interesting effect in the secondary circular reaction, but "ah, dab, mah, maaah, damaa, daaa" as you vary your response to test their effect on your environment. You are conducting experiments; you are beginning your career as a scientist.

classical conditioning A stimulus, previously neutral (**unconditioned stimulus**), can come to elicit a response (**conditioned reflex**) if paired with a stimulus (**unconditioned stimulus**) which already elicits this response (**unconditioned reflex**) (Ivan Pavlov). **Extinction** is the process of “undoing” conditioning by presenting the conditioned stimulus without the unconditioned stimulus; **generalization** refers to the fact that dogs conditioning to a whistle of one tone are also conditioned to a lesser extent to nearby tones, and **differentiation** that dogs can be taught to differentiate between two tones. A **chain reflex** is a series of linked conditioned reflexes. c.f. **instrumental conditioning**.

class reasoning see **propositional reasoning**

clinical method see **experimental method**

cognitive dissonance The motivation to change a belief or a behavior when two or more beliefs or behaviors are inconsistant. e.g. "*I smoke*" and "*smoking causes cancer*" creates pressure to stop smoking or to stop believing (Leon Festinger).

color cone A diagram to represent the three dimensions of light - brightness (axis of cone), saturation (radius of cone) and hue (circumference of cone).

compulsion see **defense mechanisms**

conceptual map see **subjective map**

concrete operations stage see **stages of cognitive development**

conditioned reflex (CR) see **classical conditioning**

conditioned stimulus (CS) see **classical conditioning**

cones see **duplicity theory**

contemporaneous explanation see **historical explanation**

contemporaneity principle see **historical explanation**

contractual relationship A relationship based on a "contract", whether explicit or implicit. I'll do this for you if you do that for me. c.f. An **intimate relationship** which is based on the intrinsic worth of the two unique people involved. They are not, as in the contractual relationship, interchangeable.

cue function see **activation theory**

cumulative record see **instrumental conditioning**

dark adaptation see **duplicity theory**

death instinct After World War 1, Sigmund Freud reluctantly concluded that we had a death instinct as well as a life instinct. "*The aim of life is death*."

deep structure see **language acquisition device** (LAD)

defense mechanisms Various strategies for dealing with thoughts that cause anxiety - pushing it down into the unconscious mind.(**repression**), justify it as having a more noble motive (**rationalization**), attribute it to others (**projection**), or pretend to the opposite thought (**reaction formation**). The two broad strategies for avoiding behavior which causes anxiety are blocking and dodging. Excessive use of blocking strategies leads to **hysteria**. **Anesthesia** is blocking at the stimulus level, **amnesia** is blocking at the central level, and **paralysis** is blocking at the response level. Excessive use of dodging strategies leads to **obsessive-compulsive neuroses**. **Obsession** is dodging by thinking of something else, and **compulsion** is dodging by doing something else. Failure of both blocking and dodging strategies leads to **phobic neuroses**.

deoxyribonucleic acid (DNA) The code in which all organisms are written. Some researchers have argued that ontogenetic memory (that acquired during the individual life of an organism), is written in **ribonucleic acid** (RNA), a biological cousin to DNA, in which phylogenetic memory (that acquired during the evolution of the species to which the organism belongs) is written.

differentiation see **classical conditioning**

ding-dong theory see **speech**

double bind A damned-if-you-do-damned-if-you-don't situation, which can lead to schizophrenia (Ronald D. Laing).

drive see **need-reduction theory**

duplicity theory The visual system consists of one system for bright illumination and another system for dim illumination. The

bright-illumination system consists of **cones**, concentrated in the centre of the eye, which contain **iodopsin** maximally sensitive to a wavelength of 560 millimicrons; the dim-illumination system consists of **rods**, concentrated in the periphery of the eye, which contain **rhodopsin**, maximally sensitive to a wavelength of 510 millimicrons. **Dark adaptation** is required when moving quickly from bright to dim illumination. Switching from one system to the other takes time.

dyslexia A reading disorder which causes serious and, until recently undiagnosed, problems in a print-based educational system.

ecosphere see **triad model**

ego Freud couched his theory of personality in dramatic terms. The three major characters of his cerebral cast are the lusty, mischievous **id**, the wise, realistic **ego**, and the nagging, moralistic **superego**.

emergentism see **reductionism**

episodic memory see **memory**

equivocation see **transmitted information**

erogenous zone see **personality development**

evolutionary psychology see **sociobiology**

experiential sensitivity see **informational sensitivity**

experimental method The basic method of science in which an independent variable is manipulated, a dependent variable is measured, and extraneous variables are controlled, to test an hypothesis. **Clinical method** is used when experimental method is inappropriate. The scientist simply listens to the person, using the method of **free association** (Sigmund Freud) or listens to a child talking spontaneously (Jean Piaget).

extinction see **classical conditioning**

extragenetic tools Tools which are outside the genetic code but still inside the body. c.f. **extrasomatic tools** - tools which are outside the body (Carl Sagan).

extrasomatic tools see **extragenetic tools**

extrinsic motivation The basic proposition of behaviorism is that a person behaves in order to gain pleasure or avoid pain. That is, motivation is extrinsic. However, there is considerable evidence of a need for stimulation and for consistency - the organic basis for knowing and understanding is built into the nervous system That is, there is **intrinsic motivation**.

fecundity The sole purpose of replicators - whether genes or memes - is to copy themselves. Good replicators have **fidelity** - they copy accurately, **fecundity** - they make many copies, and **longevity** - the copies last a long time (Richard Dawkins).

feral child a child abandoned early in life who has had minimal conditioning from society, thereby illustrating the extreme inside-out position in child rearing (e.g. The Wild Boy of Aveyron). c.f. **force-fed child -** a child who is pressured to acquire considerable information from society, thereby illustrating the extreme outside-in position in child rearing (e.g. William James Sidis).

fidelity see **fecundity**

fixation see **personality development**

fixed schedule see **schedules of reinforcement**

forcefed child see **feral child**

formal operations stage see **stages of cognitive development**

free association see **experimental method**

functional autonomy The process by which a behavior shifts from being a means to an end to being an end in itself - from fishing to catch and eat fish to fishing simply to fish.

functional disorder A **structural disorder** is one in which a malfunction can be traced to a malstructure. In the case of the nervous system, there can be malfunction for which there is no corresponding malstructure. Such **functional disorders** are not simply confessions of ignorance but disorders of the person-and-environment.

functional magnetic resonance imaging (fMRI) see **magnetic resonance imaging** (MRI)

Ganzfeld (German for "*total field*".) A device for exploring the total visual field. The "pocket Ganzfeld", consisted of two half ping-pong balls placed over the two eyes, produced the same effect as the original Ganzfeld - a six-foot diameter hemisphere.

generalization see **classical conditioning**

general systems theory (GST) study of the general principles of systems. Since all systems have much in common, learning about one system can be applied to other systems.

genital stage see **personality development**

Global Village Since instantaneous communication is now possible throughout our globe - thanks to the informatics infrastructure of computers and telephone receivers interlinked by telecommunications - our entire planet can be considered as a Global Village (Marshall McLuhan).

goal see **need-reduction theory**

gradient of reinforcement see **instrumental conditioning**

guided growth Those who view teaching as an outside-in process consider it as **guided growth**. Those who view teaching as an inside-out process focus on **natural readiness.**

hetero-phenomenology see **auto-phenomenology**

heuristics The set of skills for organizing information at the source for effective transmission. c.f. **mnemonics**, the set of skills for organizing information at the destination for effective reception.

hierarchy of needs When a person satisfies biological needs, s/he shifts gears up to social needs, and, when s/he satisfies social needs, s/he shifts gears up to psychologial needs (Abraham H. Maslow).

hippocampus see **lower brain**

historical explanation Explaining present behavior in terms of the past - conditioning (behaviorists) or trauma (psychoanalysists). c. f. **teleological explanation** - explaining present behavior in terms of the future - hopes and fears, and **contemporaneous explanation** - explaining present behavior in terms of the present. The **contemporaneity principle** is that present behavior can only be explained by present causes, since conditioning and trauma from past or hopes and fears from the future must be represented in the present (Kurt Lewin).

holocene era see **quaternary period**

homeostasis see **need-reduction theory**

Human Genome Project The breaking of the code in which our species is written. It turned into a race between public and private organizations, with the private organization winning, raising important moral and legal issues about the commercial spin-off from the resultant knowledge.

hypothetical construct A name assigned to a structure which is assumed to underly a known function. It is a sort of place-holder until the structure is identified. **Reticular activating system** (RAS) was a hypothetical structure until it was discovered that the **amygdala** served its function.

hysteria see **defense mechanisms**

id see **ego**

IMAX A film technology, developed at the National Film Board in Canada, but now exploited in the United States. Massive cameras shoot large rolls of film to be projected on to huge screens. In the IMAX theaters, the film is high enough and wide enough to include the whole visual field of the viewer, thus making the experience closer to that of the "**mind movie**". In the **OMNIMAX** theaters, this effect is further enhanced by projecting the image on a semi-circular surface.

imprinting The process by which nature leaves a gap in the unfolding of the genetic program in the development of an organism to be filled in by the environment. Researchers have explored this phenomenon by interfering with nature's plans - for example, by substituting a person for a goose as the first large moving object seen by goslings (Konrad Lorenz). The acquisition of **language** could be considered as an imprinting process, in which nature leaves a large gap to be filled in by the particular language community in which the child is developing.

informational sensitivity The sensitivity of an organism to the information available in its environment. c.f. **experiential sensitivity** - that subset of the information available in the environment which becomes part of the experience of the organism. Many empirical studies have demonstrated that information influences human behavior without becoming a part of human experience (Owen Flanagan).

information overload The proliferation of media has caused concern about information overload. However, it is only a problem if you assume that you have to assimilate it all. Those who consider education as growing from the inside-out welcome the enriched environment. There is however an underlying problem of **management of complexity.** We have to learn how to make a fuller and richer subjective map of the objective world.

Instrumental conditioning A stimulus, previously neutral, can come to elicit a response if it is instrumental in gaining access to a stimulus which already elicits a desirable response. Also called **trial-and-error learning** (Edward Thorndike). Thorndike used a **puzzle box**, which was transformed by automation by B. F. Skinner

into a **Skinner Box**. Total automation is prevented only by the fact that the rat must be taught to press the lever. This is done by a process called **shaping**, using the **method of successive approximations**. Subsequently the rat leaves its own **cumulative record** of its bar-pressing. When a response is followed by a reward, it is more likely to occur again (**law of effect**). Since all the responses are eventually followed by the reward, the law of effect must be supplemented by the **gradient of reinforcement**: the closer in time the reward to the response, the greater the strengthening effect. c. f. **classical conditioning**.

intelligence amplification (IA) see **artificial intelligence** (AI)

interval schedule see **schedules of reinforcement**

intimate relationships see **contractual relationships**

intrinsic motivation see **extrinsic motivation**

introspectionists Early psychologists who viewed psychology as the analysis of experience into its elements.

iodopsin see **duplicity theory**

kernel sentence see **language acquisition device** (LAD)

language A hierarchy of units plus rules for combining units at each level to make meaningful units at the next level. The smallest units are **phonemes** (sounds - corresponding roughly to the letters of the alphabet), which can be combined by the rules of vocabulary to create **morphemes** (smallest meaningful units - corresponding roughly to words). Those can, in turn, be combined by the rules of grammar into sentences, and those can, in turn, be combined by the rules of logic into discourses. see **imprinting**.

language acquisition device (LAD) A hypothetical construct in the brain to explain the easy acquisition of language by children during a sensitive period (Noam Chomsky). It does not unfold in a vacuum. It needs a **language-acquisition support system** (LASS) (Jerome Bruner). Person is applying built-in rules of

grammar to generate a **kernel sentence**, which can be transformed into a question, etc. by applying rules of transformation. Hence, underneath the **surface structure** of language there is the **deep structure** of thought.

language acquisition support system (LASS) see **language acquisition device** (LAD)

latency period see **personality development**

law of effect see **instrumental conditioning**

left hemisphere Since it contained the speech centres, it was considered the dominant half of the cerebral cortex. The **right hemisphere** was considered as a spare part. It is a useful heuristic to consider them as creating, respectively, conceptual and perceptual maps of the objective world. see **subjective map**.

libido see **personality development**

logical operators see **propositional reasoning**

Logo A computer language designed to teach geometry to children (Seymour Papert).

longevity see **fecundity**

long-term memory see **memory**

lower brain Structures in the lower brain, underneath the upper brain of the cerebral cortex, play significant roles in memory. The **hypocampus** is involved in the transfer of short-term memory into long-term memory; the **amygdala** in abstracting semantic memory from episodic memory; the **putamen** in procedural memory**.**

macho interface see **user interface**

magnetic resonance imaging (MRI) A medical tool which provides a 3-D image of the brain. c. f. **functional Magnetic Resonance Imagining** (fMRI) which lights up this 3-D image with the parts which are active, thus providing a means of identifying the

structures which correspond to various functions.

management of complexity see **information overload**

meme The gene is the replicating system underlying biological evolution; the meme is a second replicating system underlying cultural evolution. Genetics is the study of the gene; **memetics** is the study of the meme.

memetics see **meme**

memory Means of storing information available to our species at birth. On closer examination, it must be differentiated into **short-term memory** and **long-term memory**, **procedural memory** (riding a bicycle) and **semantic memory** (remembering a code), the latter is abstracted from **episodic memory** (recalling a past event).

method of successive approximations see **instrumental conditioning**

mind movie The mind could be considered as a magnificent movie studio which creates a “mind movie” running continuously throughout a lifetime. It also doubles as a movie theater where we can watch the show. Alas, it has only one seat and we need to become artists to show our home movies. see also **IMAX**, **visual field**.

mnemonics see **heuristics**

Moore's Law The law that computer memory will half in size and cost every 18 months. It has held for the last few decades and it is broadly assumed that it will continue to apply for some time (Gordon Moore).

morpheme see **language**

natural readiness see **guided growth**

natural selection see **theory of evolution**

need see **need-reduction theory**

need-reduction theory An organism is jerked out of a steady state (**homeostatis**) by a state of deprivation called a **need** (hunger, thirst, etc.). In order to return to this steady state it must behave appropriately with respect to some environmental object called the positive goal (eating food, drinking water). The physiological need is transformed into a psychological drive, since only the nervous system knows the environment. see also **theory of evolution**

noise see **transmitted information**

object concept You now perceive your world as composed of objects, which continue to exist even when you are no longer looking at them (object concept) and which remain the same despite the different ways you look at them - that is, they remain the same size despite variation in your distance from them, the same brightness despite variation in the illumination on them, and the same shape despite variation in your orientation to them (**object constancy**). You acquired those perceptions during your sensorimotor stage of cognitive development.

object constancy see **object concept**

objective world see **subjective map**

observer effect Since the person in the center of the **triad model** is the element of the **sociosphere**, the social sciences must deal with the **observer effect**. That is, what is observed can be changed by the act of observing it, and by the attitudes of the observer. Since the person in the center is the source of the **technosphere**, in the sciences of the artificial we must deal with the **participant effect**. That is, the effect on the person can be influenced by the actions and attitudes of the person.

obsession see **defense mechanisms**

obsessive-compulsive neurosis see **defense mechanisms**

Oedipus complex see **personality development**

OMNIMAX see **IMAX**

oof-ouch theory see **speech**

Operating Manual for Species Homo Sapiens A hypothetical manual which helps us operate our nervous systems. The author argues that all normal brains operate according to the same basic principles. Individual differences are a function of the extent to which a person learns those principles, which deal largely with the skills and tools of the four generations of media. The first generation could be considered as the conception-day gift and the other three generations as the unwrapping of this gift over historical time.

oral stage see **personality development**

ordinal reasoning see **propositional reasoning**

paralysis see d**efense mechanisms**

partial reinforcement see **schedules of reinforcement**

participant effect see o**bserver effect**

perceptron A simulation of the visual system to test certain theories about its function (Frank Rosenblatt).

perceptual map see **subjective map**

personality development (Sigmund Freud). Your life energy, or **libido**, is satisfied in turn through various **erogenous zones** - mouth (**oral stage**),anus (**anal stage**), genitals (**phallic stage**). After surviving the **Oedipus complex** (love for mother and hatred of father) and **castration complex** (fear father will castrate him)**,** the male child goes into a **latency period**, and then emerges into the **genital stage**, where the libido is directed to someone other than the mother. Many aspects of adult personality are due to failure to pass successfully through the various stages (**fixation**) or the return to a previous stage (**regression**).

phallic stage **personality development**

phobic neurosis see **defense mechanisms**

phoneme see **language**

pleasure principle see **reality principle**

pleistocene era see **quaternary period**

positive prosthetic A device which enhances human functioning rather than simply replacing a function which is damaged.

prestige see **self-esteem**

primary circular reaction see **circular reaction**

procedural memory see **memory**

projection see **defense mechanisms**

propositional reasoning Reasoning using propositions. A proposition is anything which can be said to be true or false. Thus, in a world containing two propositions, there are four possible options. **Logical operators** - if-then, either-or, etc. - are words which eliminate one or more of those options. **Class reasoning** uses logical operators - all, some, and no - to organize things into categories. **Ordinal reasoning** uses logical operators - is greater than, is equal to, is less than - to organize things along dimensions.

pro-social behaviour Positive social behaviour to offset the traditional emphasis on anti-social behaviour.

putamen see **lower brain**

puzzle box Device for studying learning in cats. The cat must learn to press a lever to get out of the box to earn “fish, friends, and freedom” (Edward Thorndike). c.f. **Skinner box** an upgraded puzzle box in which the dispensing of rewards and the recording of responses is automated (B. F. Skinner). See **instrumental conditioning.**

quaternary period The fourth period in geological time.
It is divided into the **pleistocene era** (1,800,000 to 10,000 years ago) and the **holocene era** (10,000 years ago till now).

rapid eye movements (REMs) Noticed during dreaming and thus an objective indicator of a subjective state.

ratio schedule see **schedules of reinforcement**

rationalisation see **defense mechanisms**

reaction formation see **defense mechanisms**

reality principle The ego tries to maximize truth - the reality principle; the id tries to maximizes pleasure - the **pleasure principle**. Hence, they come into conflict when truth and pleasure are incompatible.

reductionism The process of reducing a problem to a lower level in a hierarchy of systems within systems. C.f. **emergentism** - the process of raising the problem to a higher level.

redundancy A feature of language in which the probability of an element is constrained by its context. e.g. the letter after Q in English must be a U and the next letter must be a vowel. The **Shannon guessing game**, in which subjects are asked to guess which letter comes next in context, is designed to measure redundancy.

regression see **personality development**

repression see **defense mechanisms**

reticular activating system (RAS) see **hypothetical construct**

reversible figure A figure which switches figure and ground alternatively.

rhodopsin see **duplicity theory**

ribonucleic acid (RNA) see **deoxyribonucleic acid (DNA)**

right hemisphere see **left hemisphere, subjective map**

rods see **duplicity theory**

sailboat effect Sailboat technology improved considerably when the sailboat was challenged by the steamship. Hence sailboat effect refers to improvements in a technology as a result of the emergence of a competing technology.

schedules of reinforcement **Total reinforcement** means that every response is rewarded. c.f. **Partial reinforcement** in which only some responses are rewarded. Schedules of reinforcement can be a function of time - e.g. a pellet every ten seconds (**interval schedule**) or of responses - e.g. a pellet after every ten responses (**ratio schedule**). Interval and ratio schedules can be every ten seconds or every ten responses (**fixed schedule**) or, on the average, every ten seconds or every ten responses (**variable schedule**).

secondary circular reaction see **circular reaction**

self esteem Worth in one's own eyes. c. f. **prestige** - worth in the eyes of others.

self-fulfilling prophecy The tendency for something to become true because you believe that it is true. What you expect is what you get.

semantic memory see **memory**

sensory deprivation Since we have a need for stimulation, the limitation in sensory input is a very disturbing experience.

sensorimotor stage see **stages of cognitive development**

Shannon guessing game see **redundancy**

Shannon-Weaver model of communication information is transmitted by a source over a channel and received by a destination. The cri-

terion of success is the overlap between information transmitted by the source and information received by the destination (**transmitted information**). Information transmitted but not received is called **equivocation**; information received but not transmitted is called **noise**. The basic unit of information is the binary unit (**bit**) - the amount of information which cuts **uncertainty** in half.

shaping see **instrumental conditioning**

short-term memory see **memory**

siliclone A silicon clone of yourself. It consists of all your publications and presentations plus your favorite quotes and anecdotes, collected on a CD-ROM or in a web site. It serves as a satellite when you are alive and a surrogate when you are dead. People can visit your mind at your web site rather than your body at your grave site. (W. Lambert Gardiner)

Skinner box see **instrumental conditioning, puzzle box**

sociobiology A discipline which considered sociological phenomena in terms of biological concepts (E. O. Wilson). After opposing it initially, psychologists subsumed it under **evolutionary psychology.**

sociosphere see **triad model, observer effect**

speech Means of transmitting information available to our species at birth. Some theories of origin of speech: it evolved as imitation of sounds heard in nature (**ding-dong theory**), as imitation of sounds made by animals (**bow-wow theory**), out of interjections (**oof-ouch theory**), to accompany strenuous group activity (**yo-he-ho theory**).

stages of cognitive development The three major stages of cognitive development are

- **sensorimotor stage**
- **concrete operations stage**
- **formal operations stage** (Jean Piaget).

Standard Social Science Model (SSSM) The typical model underlying much social science. It assumes that the mind is a blank slate (**tabula rasa**) on which the environment writes.

structural disorder see **functional disorder**

subliminal perception perception of information below the level of awareness.

subjective map The various maps each of us has of the **objective world**. The map can be composed of images (**perceptual map**) or of words (**conceptual map**). It is a useful heuristic to associate the conceptual map with the **left hemisphere** of the brain (where the speech center is located) and the perceptual map with the **right hemisphere**.

superego see **ego**

surface structure see **language acquisition device** (LAD)

symbolic function The function of representing something with something else.

synergetic society see **antagonistic society**

tabula isola see **tabula rasa**

tabula rasa The mind is a “blank slate” on which experiences writes (John Locke). c.f. **tabula isola** Cognitive functions take place within the single, isolated brain (Merlin Donald). see **Standard Social Science Model** (SSSM)**.**

teaching machine a device containing a programme for teaching based on the principles of instrumental conditioning (B. F. Skinner).

technosphere see **triad model, observer effect**

teleological explanation see h**istorical explanation**

tertiary circular reaction see **circular reaction**

tetrad A tool for exploring the impact of any new technology. It consists of a system of four questions you should ask of each such technology (Marshall & Eric McLuhan).

theories of communication

- **transportation theory of communication** information is transported from source to destination.
- **transformation theory of communication** information is transformed at the destination since information is already stored at the destination.
- **transaction theory of communication** communication is a transaction between two people each responding to the feedback from the other.

theory of evolution The theory that species evolved through the survival of the fittest - that is, of the members of the species who best "fitted" their environment (Charles Darwin). The basic principle of the theory is **natural selection** - organisms with a fitter characteristic will be better represented in the next generation. c.f. social Darwinism - the (ab)use of the theory of evolution as a rationale (rationalization?) for certain social policies (Herbert Spencer).

theory of recapitulation the now-discarded theory that development in the womb is a hi-speed rerun of the evolution of our species.

total reinforcement see **schedules of reinforcement**

TOTE unit The basic unit of the planning function (Miller, Galanter, and Pribram). Discrepancy between a desired state and a current state is removed by a feedback loop involving TEST-OPERATE-TEST-EXIT (TOTE).

transaction theory of communication see **theories of communication**

transformation theory of communication see **theories of communication**

transmitted information Overlap between information transmitted by the source and information received by the destination. c. f. **noise** Information received by the destination but not transmitted by

the source; **equivocation** Information transmitted by the source but not received by the destination. see **Shannon-Weaver model of communication.**

transportation theory of communication see **theories of communication**

triad model A model in which the person is represented as the triple overlap of three spheres - **ecosphere** (the natural world), **sociosphere** (the social world), and **technosphere** (the person-made world). Those are the domains, respectively, of the natural science, the social sciences, and the "*sciences of the artificial*" (Herbert Simon). See **observer effect**

trial-and-error learning see **instrumental conditioning**

Turing machine An infinite loop of squares, containing either 0 or 1, passing through a device which can either change or retain that symbol. Such a machine can solve any problem which can be clearly stated (Alan Turing).

Turing test You are sitting at a terminal linked to another terminal which you can't see. If, by interacting with that other terminal, you can't tell whether it is operated by a person or a machine, then the machine has passed the Turing Test (Alan Turing).

uncertainty see **bit, Shannon-Weaver model of communication**

unconditioned reflex (UCR) see **classical conditioning**

unconditioned stimulus (UCS) see **classical conditioning**

user illusion see **user interface**

user interface The relationship between a person and a machine. Early computers were characterized by a **MACHO interface**, since they were used largely by engineers who were comfortable with

technology and technological language. As the use of computers spread beyond this select group, it was necessary for the computer to present a more friendly interface. The **WIMP** (window-icon-mouse-pulldownmenu) **interface** replaced the MACHO interface. It is based on the **user illusion** that the person is working on documents stored in folders sitting on a desktop.

vampire effect The fact that video overwhelms audio on television.

variable schedule see **schedules of reinforcement**

viral marketing Encouraging the spread of information about one's product by word of mouth.

visual field The snapshot of the world seen by a person at any moment. It could be considered as a "still" in the "**mind movie**" (J. J. Gibson).

Wallace paradox The fact that the theory of evolution can explain only how we got to a hunter-gatherer society. It can't explain how we managed the transitions from hunter-gatherer to agricultural, industrial, and now information societies over historical time. Evolution moves too slowly to explain such "sudden" changes, according to Alfred Russel Wallace.

Wernicke's area see **Broca's area**

WIMP interface see **user interface**

yo-he-ho theory see **speech**

Young-Helmholtz theory A theory of color perception based on the relative sensitivity to the light spectrum of three sets of cones. see **duplicity theory**.

REFERENCES

ABELSON & DISESSA
Harold Abelson & Andrea DiSessa
Turtle Geometry: The Computer as a Medium for Exploring Mathematics
Cambridge, Massachusetts: MIT Press, 1986

ASCH
Solomon E. Asch
Effects of group pressure on the modification and distortion of judgements
Readings in Social Psychology
(Third Edition)
New York: Holt, Rinehart & Winston, 1958, Pages 174-183

AUNGER 2000
Robert Aunger (Editor)
Darwinizing Culture:
The Status of Memetics as a Science
Oxford: Oxford University Press, 2000

AUNGER 2002
Robert Aunger
The Electric Meme:
A New Theory of How We Think
New York: The Free Press, 2002

BARDINI
Thierry Bardini
Bootstrapping:
Douglas Engelbart, Coevolution, and the Origins of Personal Computing
Stanford, California: Stanford University Press, 2000

BARKOW ET AL
Jerome H. Barkow, Leda Cosmides & John Tooby (Editors)
The Adapted Mind: Evolutionary Psychol ogy and the Generation of Culture
New York: Oxford University Press, 1992

BARTHES
Barthes, Roland
Mythologies
London: Paladin, 1973

BATESON
Gregory Bateson
Steps to an Ecology of Mind
Chicago, Illinois: University of Chicago Press, 1972

BECKER
Ernest Becker
The Denial of Death
New York: Free Press, 1973

BERELSON & STEINER
Bernard Berelson & Gary Steiner
Human Behaviour:
An Inventory of Scientific Findings
New York: Harcourt, Brace & World, 1964

BLACKMORE
Susan Blackmore
The Meme Machine
Oxford: Oxford University Press, 1999

BRAND
Stewart Brand
The Media Lab: Inventing the Future at MIT
New York: Viking, 1987

BRANWYN
Gareth Branwyn
The desire to be wired
Wired, September/October 1993,
Pages 62-65, 113

BRODIE
Richard Brodie
Virus of the Mind:
The New Science of the Meme
Seattle, Washington: Integral Press, 1996

BROOKS
Rodney A. Brooks
Flesh and Machines:
How Computers will Change Us
New York: Pantheon, 2002

BRUNER
Jerome T. Bruner
Child's Talk
New York: W. W. Norton, 1988

BURNSIDE — John Burnside
A Lie About My Father
St. Paul, Minnesota: Greywolf Press, 2007

CALVIN — William H. Calvin
A Brief History of the Mind: From Apes to Intellect and Beyond
Oxford: Oxford University Press, 2004

CAPRA — Fritjof Capra
The Web of Life
New York: Doubleday, 1996

CARTER 1998 — Rita Carter
Mapping the Mind
London: Weidenfeld & Nicolson, 1998

CARTER 2001 — Rita Carter
Mapping the Memory: Understanding Your Brain to Improve Your Memory
Berkeley, California: Ullyses Press, 2001

CHOMSKY 1959 — Noam Chomsky
Review of B. F. Skinner "Verbal Behavior"
Language, 1959, 35, Pages 26-58

CHOMSKY 1966 — Noam Chomsky
Cartesian Linguistics
New York: Harper & Row, 1966

CLARK — Andy Clark
Natural-born Cyborgs: Why Minds and Technologies are Made to Merge
Oxford: Oxford University Press, 2003

COOPERSMITH — S. Coopersmith
The Antecedents of Self-Esteem
San Francisco: Freeman, 1967

COVINGTON & BEERY — M. V. Covington & R. G. Beery
Self-Worth and School Learning
New York: Holt, Rinehart & Winston, 1976

CSIKSZENT-MIHALYI
Mihaly Csikszentmihalyi
The Evolving Self:
A Psychology for the Third Millenium
New York, Harper Collins, 1993.

DARWIN 1859
Charles Darwin
On the Origin of Species
London: John Murray, 1859

DARWIN 1872
Charles Darwin
The Expression of the Emotions in Man and Animals
New York: Barnes & Noble, 2007
(First published in 1872)

DAWKINS
Richard Dawkins
The Selfish Gene
Oxford: Oxford University Press, 1976

DEACON
Terrence W. Deacon
The Symbolic Species: The Co-evolution of Language and the Brain
New York: W. W. Norton, 1997

DECI
E. L. Deci
Intrinsic Motivation
New York: Plenum Press, 1975

DEGLER
Carl N. Degler
In Search of Human Nature:
The Decline and Revival of Darwinism in American Social Thought
New York: Oxford University Press, 1991

DE KERCK-HOVE 1995
Derrick de Kerckhove
The Skin of Culture:
Investigating the New Electronic Reality
Toronto: Somerville House, 1995

DE KERCK-HOVE 1997 — Derrick de Kerckhove
Connected Intelligence: The Arrival of the Web Society
Toronto: Somerville House, 1997

DENNETT 1987 — Daniel C. Dennett
The Intentional Stance
Cambridge, Massachusetts: MIT Press, 1987

DENNETT 1991 — Daniel C. Dennett
Consciousness Explained
Boston: Little, Brown, 1991

DESMOND & MOORE — Adrian Desmond & James Moore
Darwin: The Life of a Tormented Evolutionist
New York: W. W. Norton, 1991

DIAMOND — Jared Diamond
Guns, Germs, and Steel: The Fates of Human Societies
New York: W. W. Norton, 1999

DONALD — Merlin Donald
A Mind So Rare: The Evolution of Human Consciousness
New York: W. W. Norton, 2001

DUNBAR — Robin Dunbar
Grooming, Gossip, and the Evolution of Language
London: Faber & Faber, 1996

EKMAN — Paul Ekman
Darwin and Facial Expression: A Century of Research in Review
Cambridge, Massachusetts: Malor Books, 2006

FESTINGER ET AL — Leon Festinger, H. W. Reicken & Stanley Schachter
When Prophecy Fails
Minneapolis: Minnesota University Press, 1956

FLANAGAN 1991 — Owen J. Flanagan
The Science of the Mind (Second Edition)
Cambridge, Massachusetts: MIT Press, 1991

FLANAGAN 1999 — Owen J. Flanagan
Dreaming Souls: Sleep, Dreams, and the Evolution of Mind
Oxford: Oxford University Press, 1999

FRANKFURT — Harry G. Frankfurt
On Bullshit
Princeton, New Jersey: Princeton University Press, 2005

FREEZE — Colin Freeze
Building Trust Via Nasal Spray
Globe and Mail, 2 June 2005, Pages A1, A6

FREUD 1965 — Sigmund Freud (Edited by James Strachey)
New Introductory Lectures on Psycho analysis
New York: W. W. Norton, 1965

FREUD 1900 — Sigmund Freud (Edited by James Strachey)
Interpretation of Dreams
New York: Avon, 1983 (First Published in 1900)

FUKUYAMA — Francis Fukuyama
The End of History and the Last Man
New York: Free Press, 1992

GARDINER 1970 — W. Lambert Gardiner
Psychology: A Story of a Search
Monterey, California: Brooks/Cole, 1970, 1973

GARDINER 1980 W. Lambert Gardiner
The Psychology of Teaching
Monterey, California: Brooks/Cole, 1980

GARDINER 1987 W. Lambert Gardiner
The Ubiquitous Chip: The Human Impact of Electronic Technology
Hudson Heights, Quebec: Scot & Siliclone, 1987

GARDINER 2002 W. Lambert Gardiner
A History of Media
Victoria, B. C.: Trafford, 2002

GARDINER 2006 W. Lambert Gardiner
Media: Past, Present and Future
Bethedsa, Maryland: Academica Press, 2006

GARDINER 2009 W. Lambert Gardiner
Turning Teaching Inside-Out
(in preparation)

GIBSON J 1966 James J. Gibson
The Senses Considered as Perceptual Systems
Boston: Houghton Mifflin, 1966

GIBSON J 1979 James J. Gibson
The Ecological Approach to Visual Perception
Boston: Houghton Mifflin, 1979

GIBSON W 1984 William Gibson
Neuromancer
New York: Ace, 1984

GIBSON W 1987 William Gibson
Count Zero
New York: Ace, 1987

GIBSON W 1988
William Gibson
Mona Lisa Overdrive
New York: Bantam, 1988

GIBSON W 1996
William Gibson
Idoru
New York: Berkley Books, 1996

GIBSON W & STERLING B
William Gibson & Bruce Sterling
The Difference Engine
London: Victor Gollancz, 1990

GLADWELL
Malcolm Gladwell
The Tipping Point: How Little Things Can Make a Big Difference
San Francisco, California: Back Bay Books, 2004

GOLDFRIED & MERBAUM
M. R. Goldfried & M. Merbaum
Behavior Change Through Self-Control
New York: Holt, Rinehart & Winston, 1973

GOULD
Stephen Jay Gould
Wonderful Life: The Burgess Shale and the Nature of History
New York: W. W. Norton, 1989

GRAY ET AL
Chris Hables Gray (Editor)
The Cyborg Handbook
London: Routledge, 1995

GROSSMAN
Lev Grossman
Meet the Chipsons
Time, 11 March 2002, Pages 44-45

HARAWAY
Donna J. Haraway
Simians, Cyborgs, and Women: The Reinvention of Nature
London: Routledge, 1991

HARLOW Harold F. Harlow
The Nature of Love
American Psychologist, 1958, 13,
Pages 673-685

HAYLES Katherine N. Hayles
How We Became Post-human: Virtual Bodies in Cybernetics, Literature, Informatics
Chicago: University of Chicago Press, 1999

HEBB Donald O Hebb
The Organisation of Behaviour
New York: John Wiley, 1949

HERON W. Heron
The Pathology of Boredom
Scientific American, 1957, 196 (1),
Pages 52-56

HEYLIGHEN Francis Heylighen
Evolution of memes on the network: From chain-letters to the global brain
in Ingrid Fischer, Editor
Ars Electronica Catalogue
Vienna/New York: Springer, 1996

HOCKETT Charles F. Hockett
Animal "languages" and human language
Human Biology, 1959, 31, Pages 32-39

HOFSTADTER Douglas R. Hofstadter
On Viral Sentences and Self-Replicating Structures
Scientific American, Volume 248, January 1983

HOMER-DIXON Thomas Homer-Dixon
The Ingenuity Gap
Toronto: Random House of Canada, 2001

HUTCHEON — Pat Duffy Hutcheon
Leaving the Cave: Evolutionary Naturalism in Social-Scientific Thought
Waterloo, Ontario: Wilfred Laurier University Press, 1996

INGRAM — Jay Ingram
Consumed by Learning, Pages 77-86 in
The Barmaid's Brain: and Other Strange Tales from Science,
Toronto: Viking, 1998

INNIS 1950 — Harold A. Innis
Empire and Communication
Oxford: Oxford University Press, 1950

INNIS 1951 — Harold A. Innis
The Bias of Communication
Toronto: University of Toronto Press, 1951

ITARD — J. M. G. Itard
(Translated by G. & M. Humphrey)
The Wild Boy of Aveyron
New York: Appleton-Century-Crofts, 1962
(Originally published in 1932)

JEAN PIAGET FOUNDATION — Jean Piaget Foundation
Studies in General Epistemology:
The Jean Piaget Bibliography (37 Volumes)
Geneva, Switzerland: Jean Piaget Foundation, 1989

JONES — Ernest Jones
Life and Work of Sigmund Freud
New York: Penguin Putnam

JOURNAL OF COMMUNIC-ATION — Journal of Communication
Ferment in the Field
Journal of Communication, Summer 1983, 33 (3)

KELLER
Helen Keller
Story of My Life
New York: Bantam, 1991

KELLY
Kevin Kelly
Out of Control: The New Biology of Ma chines, Social Systems, and the Economic World
Reading, Massachusetts: Addison-Wesley, 1994

KEY 1974
Wilson Bryan Key
Subliminal Seduction
New York: New American Library, 1974

KEY 1976
Wilson Bryan Key
Media Sexploitation
New York: New American Library, 1976

KINGSBURY
Donald Kingsbury
Psychohistorical Crisis
New York: Tom Doherty Associates, 2001

KINKADE
Kathleen Kinkade
A Walden Two Experiment: The First Five Years of Twin Oaks Community
New York: William Morrow, 1974

KLEITMAN
Nathaniel Kleitman
Patterns of Dreaming
Scientific American, 1960, 203(5), Pages 82-88

KROKER 1984
Arthur Kroker
Technology and the Canadian Mind: Innis, McLuhan, Grant
Montreal: New World Perspectives, 1984

KROKER 1993
Arthur Kroker
Spasm: Virtual Reality, Android Music, Electric Flesh
New York: St. Martin's Press, 1993

KROKER & WEINSTEIN — Arthur Kroker & Michael A. Weinstein
Data Trash: The Theory of the Virtual Class
Montreal: New World Perspectives, 1994

KUHNS — Kuhns, William,
Twice as natural: Speculations on the emerging information culture
in Howard Didsbury Jr. (Editor)
Communication and the Future: Prospects, Promises and Problems
Bethesda, Maryland: World Future Society, 1982, Pages 53-61

KURZWEIL — Ray Kurzweil
The Singularity is Near:
When Humans Transcend Biology
New York: Penguin, 2006

LAING — R. D. Laing
Knots
Harmondsworth, Middlesex: Penguin, 1970

LAING & ESTERSON — R. D. Laing & A. Esterson
Sanity, Madness, and the Family
New York: Penguin, 1964

LASHLEY — Kurt S. Lashley
Mass action in cerebral function
Science, 1931, 73, Pages 245-254

LEFRANCOIS — Guy R. Lefrancois
Psychology for Teaching:
A Bear Never Faces the Front (Fifth Edition)
Belmont, California: Wadsworth, 1985

LEONARD — William Ellery Leonard
The Locomotive God
New York: Century, 1927

LEVINSON 1997 — Paul Levinson
The Soft Edge: A Natural History and Future of the Information Revolution

London: Routledge, 1997

LEVINSON 1999 Paul Levinson
Digital McLuhan:
A Guide to the Information Millennium
London: Routledge, 1999

LOGAN 1986 Robert K. Logan
The Alphabet Effect: The Impact of the Phonetic Alphabet on the Development of Western Civilisation
New York: St. Martin's Press, 1986

LOGAN 1995 Robert K. Logan
The Fifth Language:
Learning a Living in the Computer Age
Toronto: Stoddart, 1995

LOGAN 2000 Robert K. Logan
The Sixth Language:
Learning a Living in the Internet Age
Toronto: Stoddart, 2000

LORENZ Konrad Lorenz
On Aggression
New York: Harcourt Brace Jovanovitch, 1966

LUMSDEN & WILSON Charles J. Lumsden & Edward O. Wilson
Promethean Fire:
Reflections on the Origin of Mind
New York: Replica Books, 2001

MADDI & COSTI S. R. Maddi & P. T. Costi
Humanism in Personology:
Allport, Maslow, and Murphy
Chicago: Aldine, 1972

MADDOX Brenda Maddox
Rosalind Franklin: The Dark Lady of DNA
New York: HarperCollins, 2002

MAHONEY & THORESON
M. J. Mahoney & C. E. Thoreson
Self-Control: Power to the Person
Monterey, California: Brooks/Cole, 1974

MANN & NIEDZVIECKI
Steve Mann & Hal Niedzviecki
Cyborg: Digital Destiny and Human Possibilities in the Age of the Wearable Computer
Toronto: Doubleday Canada, 2001

MASLOW 1954
Abraham H. Maslow
Motivation and Personality
New York: Harper & Row, 1954

MASLOW 1963
Abraham H. Maslow
The need to know and the fear of knowing
The Journal of General Psychology, 1963, 68, Pages 111-125

MASLOW 1964
Abraham H. Maslow
Synergy in the society and in the individual
Journal of Individual Psychology, 1964, 20, Pages 153-164

MASLOW 1979
Abraham H. Maslow
The Journals of A. H. Maslow (2 Volumes)
Monterey, CA: Brooks/Cole, 1979

MATURANA & VARELA
Humberto R. Maturana & Francisco J. Varela
The Tree of Knowledge: The Biological Roots of Human Understanding
Boston, Massachusetts: Shambhala Publications, 1987

MCCONNELL
James V. McConnell
Memory transfer through cannibalism in planarians
Journal of Neuropsychiatry, August 1962, 3, Supplement 1, Pages 42-48

MCLUHAN E
Eric McLuhan
Electric Language: Understanding the Message
Toronto: Buzz Books, 1998

MCLUHAN M — Marshall McLuhan
Understanding Media: The Extensions of Man
New York: McGraw-Hill, 1964

MCLUHAN M & MCLUHAN E — Marshall McLuhan & Eric McLuhan
Laws of Media: The New Science
Toronto: University of Toronto Press, 1988

MCLUHAN & NEVITT — Marshall McLuhan & Barrington Nevitt
Meaning Medium Message
Communication 1974, 1, Pages 27-33

MILGRAM — Stanley Milgram
Obedience to Authority: An Experimental View
New York: Harper, 2004

MILLER — George A. Miller
The Magical Number Seven Plus or Minus two: Some Limits on Our Capacity to Process Information
Psychological Review, 1956, 63, Pages 81-97

MILLER ET AL — George Miller, Eugene Galanter & Karl Pribram
Plans and the Structure of Behaviour
New York: Holt, Rinehart & Winston, 1960

MUSSEN & EISENBERG-BERG — P. Mussen & N. Eisenberg-Berg
Roots of Caring, Sharing, and Helping: The Development of Pro-Social Behavior in Children
San Francisco: W. H. Freeman, 1977

NEGROPONTE — Nicholas Negroponte
Being Digital
New York: Random House, 1995

NIELSEN — Jakob Nielsen
Hypertext & Hypermedia
San Diego, California: Academic Press, 1990

NORRE-TRANDERS — Tor Norretranders
The User Illusion: Cutting Consciousness Down to Size
New York: Viking, 1998

PACKARD — Vance Packard
The Hidden Persuaders
New York: Pocket Books, 1957

PAPERT 1980 — Seymour Papert
Mindstorms: Children, Computers and Powerful Ideas
New York: Basic Books, 1980

PAPERT 1993 — Seymour Papert
The Children's Machine: Rethinking School in the Age of the Computer
New York: HarperCollins, 1993

PASK & CURRAN — Gordon Pask & Susan Curran
Microman: Computers and the Evolution of Consciousness
New York: Macmillan, 1982

PAVLOV — Ivan Petravich Pavlov
(Edited & translated by G. V. Anrep)
Conditioned Reflexes: An Investigation of the Physiological Activity of the Cerebral Cortex
London: Oxford University Press, 1927

PENFIELD & ROBERTS — W. Penfield & L. Roberts
Speech and Brain Mechanisms
Princeton: Princeton University Press, 1959

PENNY — Laura Penny
Your Call in Important to Us: The Truth About Bullshit
Toronto: McClelland & Stewart, 2005

PERCY Walker Percy
The Message in the Bottle
New York: Farrar, Straus & Giroux, 1982

PETERS John Durham Peters
Speaking Into the Air:
A History of the Idea of Communication
Chicago: University of Chicago Press, 1999

PIAGET 1929 Jean Piaget
The Child's Conception of the World
New York: Harcourt, Brace, 1929

PIAGET 1930 Jean Piaget
The Child's Conception of Physical Causality
London: Kegan, Paul, 1930

PIAGET 1951 Jean Piaget
Play, Dreams and Imitation in Childhood
New York: Norton, 1951

PIAGET 1952 Jean Piaget
The Child's Conception of Number
New York: Humanities, 1952

PIAGET 1954 Jean Piaget
The Construction of Reality in the Child
New York: Basic Books, 1954

PINKER 1994 Steven Pinker
The Language Instinct
New York: HarperCollins, 1994

PINKER 1997 Steven Pinker
How the Mind Works
New York: W. W. Norton, 1997

PINKER 1999 Steven Pinker
Words and Rules:
The Ingredients of Language
New York: Basic Books, 1999

PINKER 2002 Steven Pinker
The Blank Slate:
The Modern Denial of Human Nature
New York: Viking, 2002

PINKER 2007 Steven Pinker
The Stuff of Thought: Language as a Window into Human Nature
New York: Viking, 2007

POWE 1987 Bruce W. Powe
The Solitary Outlaw:
Trudeau, Lewis, Gould, Canelli, McLuhan
Toronto: Lester & Orpen Dennys, 1987

POWE 1993 Bruce W. Powe
A Tremendous Canada of Light
Toronto: Coach House, Press, 1993

POWE 1995 Bruce W. Powe
Outage: A Journey into Electric City
Toronto: Random House of Canada, 1995

RHEINGOLD 1985 Howard Rheingold
Tools for Thought: The People and Ideas Behind the Next Computer Revolution.
New York: Simon & Schuster, 1985

RICHARDS A. Richards
Hunger and Work in a Savage Tribe.
Reported in M. Bates,
Gluttons and Libertines: Human Problems of Being Natural
New York: Random House, 1958

ROMANES G. J. Romanes
Animal Intelligence
New York: Appleton-Century-Crofts, 1912
(Originally published in 1882)

ROSENBERG Samuel Rosenberg
The Come As You Are Masquerade Party
Englewood Cliffs, New Jersey: Prentice-Hall, 1970

ROSENBLATT Frank Rosenblatt
Principles of Neurodynamics: Perceptrons and the Theory of Brain Mechanisms
Washington, D, C,: Spartan Books, 1972

ROSENHAN David L. Rosenhan
On Being Sane in Insane Places
Science, 1973, 179 (70), Pages 250-258

ROUSSEAU Jean-Jacques Rousseau
Translated and Edited By William Boyd
The Emile of Jean Jacques Rousseau:
Selections (Classics in Education)
New York: Columbia University, 1965

RUCKER ET AL Rudy Rucker, R. U. Sirius & Queen Mu
Mondo 2000: A User's Guide to the New Edge
New York: HarperCollins, 1992

RUSHKOFF Douglas Rushkoff
Media Virus
New York: Ballantine Books, 1996

RUSSELL P. Russell
The Global Brain Awakens: Our Next Evolutionary Leap
Miles River Press, 1995

SAGAN Carl Sagan
The Dragons of Eden: Speculations on the Evolution of Human Intelligence
New York: Ballantine, 1977

SAYRE Anne Sayre
Rosalind Franklin and DNA
New York: W. W. Norton, 1975

SCHWARTZ
Tony Schwartz
The Responsive Chord
Garden City, New York: Doubleday, 1972

SELLAR & YEATMAN
W. C. Sellar & R. J. Yeatman
1066 And All That:
A Memorable History of England
London: Mentheun, 1930

SHANNON & WEAVER
Shannon, Claude & Warren Weaver
The Mathematical Theory of Communication
Urbana, Illinois: University of Illinois Press, 1949

SHELLEY
Mary Shelley
Frankenstein or The Modern Prometheus
Oxford: Oxford University Press, 1969

SHENK
David Shenk
Data Smog: Surviving the Information Glut
New York: HarperCollins, 1997

SHREEVE
James Shreeve
The Genome War: How Craig Venter Tried to Capture the Code of Life and Save the World
New York: Ballantine Books, 2005

SIMON
Herbert A. Simon
The Sciences of the Artificial
Cambridge, Massachusetts: MIT Press, 1969

SKINNER 1957
B. F. Skinner
Verbal Behaviour
New York: Appleton-Century-Crofts, 1957

SKINNER 1960
B. F. Skinner
Walden Two
New York: Macmillan, 1960

SKINNER 1972
B. F. Skinner
Beyond Freedom and Dignity
New York: Bantam, 1972

SLATER
Lauren Slater
Opening Skinner's Box: Great Psychological Experiments of the Twentieth Century
New York: W. W. Norton, 2004

SPANNER
Spanner
Integrated data processing officially opened
Spanner, April 1957, Pages 4-8, 18-20

SPITZ
R. A. Spitz
Hospitalism: An inquiry into the genesis of psy chiatric conditions in early childhood
in Fenichel et al, (Editors)
The Psychoanalytical Study of the Child
(Volume 1)
New York: International Universities Press, 1945

STEPHENSON 1992
Neal Stephenson
Snow Crash
New York: Bantam, 1992

STEPHENSON 1999
Neal Stephenson
Cryptonomicon
New York: Avon, 1999

STOCK
Gregory Stock
Metaman: The Merging of Humans and Machines into a Global Superorganism
New York: Doubleday, 1993

SYKES
Bryan Sykes
The Seven Daughters of Eve
New York: W. W. Norton, 2001

THOMPSON
William Irwin Thompson
At The Edge of History
New York: Harper & Row, 1971

THORNDIKE
Edward L. Thorndike
Animal Intelligence
New York: Macmillan, 1911

TOFFLER
Alvin Toffler
Future Shock
New York: Bantam, 1971

TURING
Alan M. Turing
Computing machinery and intelligence
Mind, 1950, 59, Pages 285-310

VEBLEN
Thorstein Veblen
The Theory of the Leisure Class
New York: Penguin, 1994
(first published in 1899)

VON FRISCH 1950
Karl von Frisch
Bees: Their Vision, Chemical Senses, and Language
New York: Cornell University Press, 1950

VON FRISCH 1967
Karl von Frisch
The Dance Language and Orientation of Bees
Cambridge, Massachusetts: Harvard University Press, 1967

WALLACE
Patricia Wallace
The Psychology of the Internet
Cambridge, UK: Cambridge University Press, 1999

WARWICK
Kevin Warwick
I, Cyborg
London: Century, 2002

WASHBURN
Jennifer Washburn
University, Inc.: The Corporate Corruption of Higher Education
New York: Basic Books, 2005

WATSON JA
James A. Watson
The Double Helix: A Personal Account of the Discovery of the Structure of DNA
New York: Touchstone, 2001

WATSON JO
John B. Watson
Behaviourism
Chicago: University of Chicago Press, 1924

WATSON JO & RAYNER
John B. Watson & Rosalie Rayner
Conditioned emotional reactions
Journal of Experimental Psychology, 1920, 3, Pages 1-14

WATZLAWICK
Paul Watzlawick
How Real is Real?: Confusion, Disinformation, Communication
New York: Random House, 1977

WEIZENBAUM
Joseph Weizenbaum
Computer Power and Human Reason
New York: Penguin, 1984

WELLS H
H. G. Wells
Outline of History (2 Volumes)
New York: Scholarly Press, 1974 (1920)

WELLS S
Spencer Wells
Deep Ancestry: Genographic Project
Washington, D. C.: National Geographic Society, 2006

WHORF
Benjamin Lee Whorf
John B. Carroll (Editor)
Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf
Cambridge, Massachusetts: MIT Press, 1964

WILSON 1975
Edward O. Wilson
Sociobiology: The New Synthesis
Cambridge, Massachusetts: Harvard University Press, 1975

WILSON 1998 Edward O. Wilson
Consilience: The Unity of Knowledge
New York: Knopf, 1998

ZIMBARDO Philip Zimbardo
The Lucifer Effect: Understanding How Good People Turn Evil
New York: Random House, 2008

ZURIF Edgar B. Zurif
Syntactic and Semantic Composition
Brain and Language, January 2000, 71 (1), Pages 261-263

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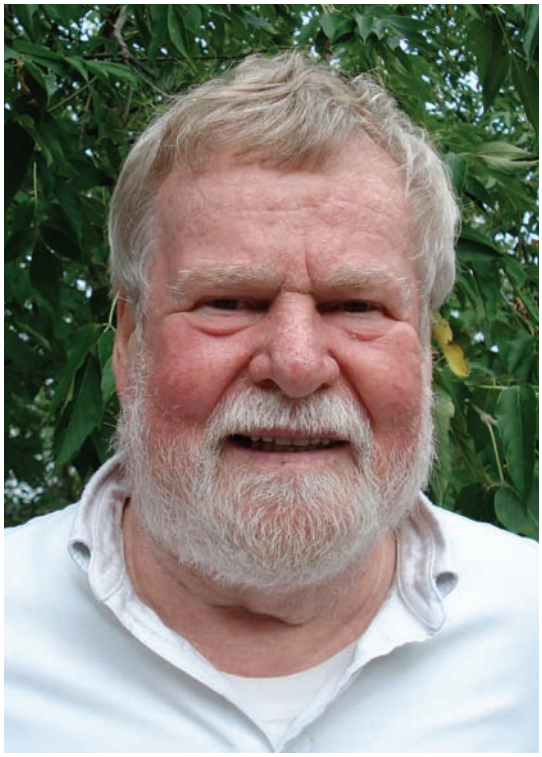

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